ANALOG

SCIENCE FICTION AND FACT

DECEMBER 2004

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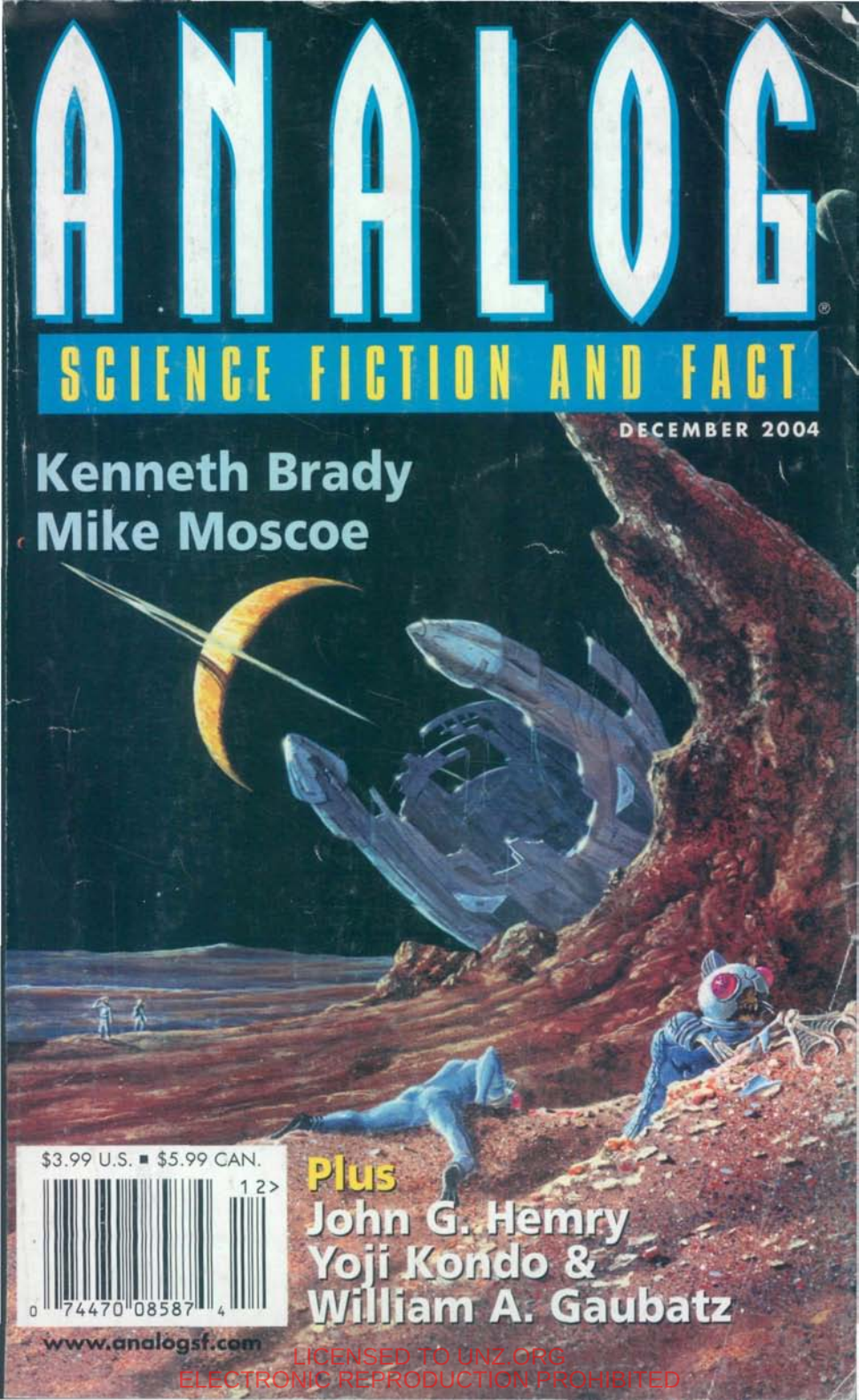

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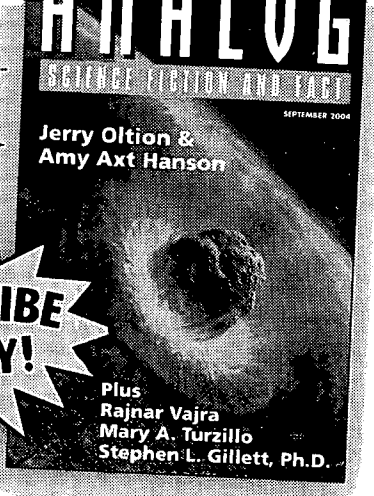

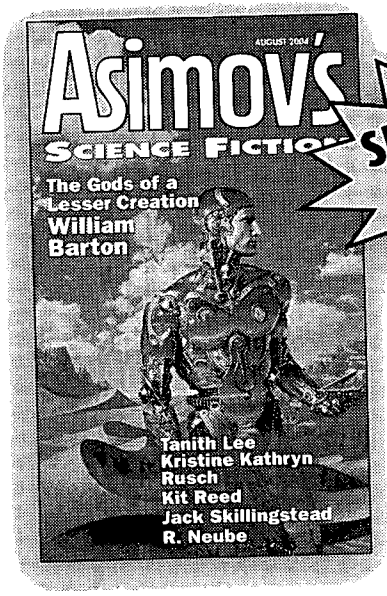

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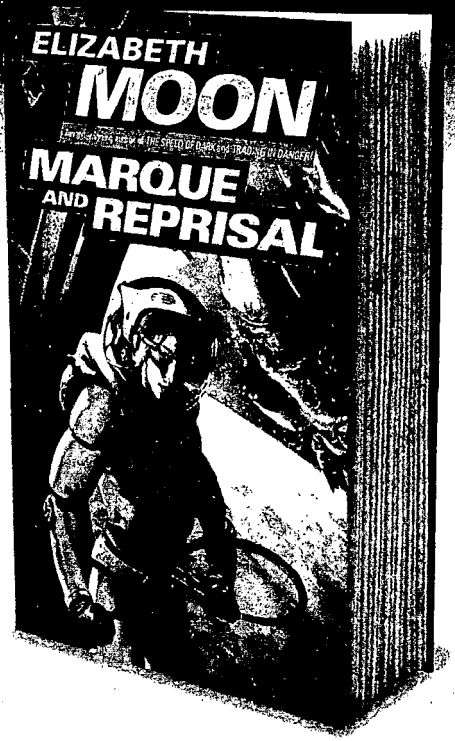

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EDITORIAL Stanley Schmidt

TOP PREDATOR

All ecosystems include predators, and somewhere among them is a *top* predator—but it may not be what you think.

In general terms, an ecosystem is a group of plants and/or animals, together with the rest of their environment, that interact in ways that constitute a more or less stable and self-sustaining system. Typically, at least on Earth, an ecosystem includes both plants and animals. At the most basic level of interaction, photosynthesizing plants and microorganisms like blue-green algae use solar energy to power their own biochemical reactions, in the process storing some of it in chemical forms that can be utilized by animals (such as caterpillars, rabbits, or deer) eating the plants. Other animals (such as sparrows, hawks, or wolves) in turn eat the plant-eaters, and in turn may be eaten by still other animals. Carnivores that eat other carnivores are commonly larger than their prey, but there can be exceptions, like a school of piranha devouring a peccary or jaguar.

Note that an ecosystem is not generally a closed system, unless you look at things on quite a large scale. We might, for example, analyze an Everglades hammock as an ecosystem, but it can't keep running without the continuous or cyclic input of energy from the Sun. It used to be commonly said that all life on Earth ran directly or indirectly on solar energy, but it now turns out that there are other possibilities, such as the thermal vents that drive isolated, self-contained ecosystems deep in the oceans.

Nor is an ecosystem a linear chain. The relationships among eaters and eaten can get rather intricate. The one constant seems to be that, except for the plants and microorganisms that work directly with the primary energy source, everything must eat and eventually be eaten. Even those carnivores too big and powerful to be eaten by anything bigger and stronger eventually die and are recycled by scavengers and microorganisms that break them back down into nutrients for plants. So the whole thing is cyclical—sometimes a simple cycle involving a small number of organisms, but more often a whole web of interlocking cycles involving many kinds of organisms, each playing a particular role.

Critters that eat other critters are commonly referred to as predators, though in a broader sense even herbivores are really predators since they, too, get their energy by consuming other organisms. It's common to speak of predators as higher or lower on the food chain depending on how many steps removed they are from the plants at the "bottom." A "top" predator is one like a wolf, lion, or muskellunge, not normally preyed upon by anything else while alive and therefore enjoying a uniquely favored form of security. By extension, "predator" is often applied to beings that attack others even if they don't do it for the purpose of eating their victims—though such behavior is far rarer in the animal kingdom at large than folklore might lead you to believe.

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Humans are a special case. For better or worse, we tend to be the top predator anywhere we get the chance, and our kind has tended to be extremely intolerant of anything else in that role. Wolves, for the most part, kill to eat. Humans, for most of their history, have killed wolves to keep them from eating. As a result, high-order predators like wolves, lions, and cougars have been methodically exterminated from many areas where they were once dominant, and the humans who did so made it sound positively noble. "Remove the evil scourge," they proclaimed, "and make the world safe for civilization and *good* animals like deer and rabbits." (As almost any newspaper routinely illustrates, humans also breed their own predators: individuals who prey on members of their own species. But that's another story.)

In recent decades, more and more people have come to realize, at least dimly, that predators cannot be regarded as simply evils to be done away with. (Not everybody—I've even known scientists who were quite brilliant in their own non-biological fields but had negligible understanding of ecology and negligible interest in learning.) An ecosystem is a dynamically balanced thing, and predators are essential working parts of it. They control the numbers of the animals they prey on, keeping them in balance with the plants *they* prey on. Remove the predators, and the herbivores proliferate until they wipe out their food supply, causing their population to crash.

To the extent that humans have learned this, they have, not surprisingly, done it the hard way. In many parts of the United States wolves and cougars were long since hunted to extinction. Within a few decades deer populations had expanded to the point where few of them got enough to eat, most individuals were malnourished, the forests had little undergrowth, and deer had become common yard pests and traffic hazards. Deer populations aren't *completely* unchecked; humans are now their only significant predator, but not a very effective one. Most deer are now killed by cars and feed only scavengers; some are shot by hunters and eaten, but relatively few as it has become fashionable to look down on hunters as "barbaric." The total killed by vehicles and hunters is still too small to maintain a healthy ecological balance, and the population continues to grow.

And then there are cases like Australia, where alien animals (rabbits) were deliberately but misguidedly introduced to a place where they would have no significant predators, and soon became a massive problem in themselves.

Such experiences have led to a gradual shift in attitudes toward predators. Where once many had bounties on their heads, encouraging people to kill as many as possible with the open goal of

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extermination, now many have been given some level of protection. In a few cases, as with wolves in Yellowstone National Park, they've been deliberately reintroduced to some of their former territories (though seldom without objections from farming or ranching neighbors). Acceptance of such ideas is far from universal or complete, but the prevailing range of attitudes has come a long way from where it was a few decades ago. Back then, even park rangers thought of big carnivores as menaces to be eliminated. Now they, and a growing number of others, understand that those carnivores or something like them must be integrated into any viable ecosystem.

Even we are not necessarily the real top predator. After the 2004 World Science Fiction Convention in Toronto I spent some very refreshing time in the wilderness of Algonquin Provincial Park. While driving back to Toronto, I found a science program on CBC radio about how people's attitudes toward forest fires have changed in the U.S., and are starting to change in Canada. A few decades ago, the prevailing wisdom, again not only among the general public but among those responsible for managing national parks and forests, was that fire is the enemy of forest, a destructive scourge to be prevented at all costs.

Under that philosophy, huge expanses of forest were artificially protected from fire for so long that when one finally got started, the woods were just full of tinder and fuel. The resulting conflagration was far more devastating than it would have been if smaller fires had been allowed to occur spontaneously from time to time. Well-known example: the huge Yellowstone fires of the summer of 1988 (though those also brought the lesson, a few years later, that ecosystems often have remarkable capacities for recovery).

Ecologists were gradually driven to the realization that fire is a normal and essential part of many ecosystems. Some trees, for example, produce seeds that can't even germinate until they're stimulated by fire. Many ecosystems depend on periodic burns to clear land, feed new nutrients into the soil, and start a fresh cycle of ecological succession. Such new insights have led to radical changes in forest management. Where once fires caused by lightning strikes would have been squelched as quickly as possible, now they're often allowed

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Sometimes fires are sometimes deliberately set, "controlled burns" for the express purpose of inducing a transition for which a piece of an ecosystem is overdue.

It struck me while listening to this interview that the changes in attitudes toward forest fires showed remarkably close parallels to those in attitudes toward predators. Moreover, the role fires play in those ecosystems is functionally similar to that of predators.

And it occurred to me that it's no stretch at all to say that fire *is* a predator—the real top predator in many ecosystems.

That, in turn, suggests the possibility that on a still larger scale, still other things might play a top-predator role—things like earthquakes, ice ages, volcanic eruptions, and asteroid impacts. Or even bigger things, some of which have been imagined in science fiction—but surely not all. In Poul Anderson's *Fire Time*, for example, a somewhat Earthlike planet orbits a somewhat Sunlike star—with a red giant in a big, eccentric orbit around both. When the giant gets close enough, its added heat causes a period—about a hundred Earth-years out of its thousand-year period—of extreme ecological disruption, the "fire time" of the title. Yet while that seems like extreme disruption to anyone whose lifetime overlaps fire time, in a larger sense it isn't disruption at all, but a normal part of a very long ecological cycle—to which the planet's life has adapted.

How many other such cases, even stranger, might be possible? Probably quite a few, for a writer willing and able to explore the possibilities. The crucial thing to remember is this: that in a very real, even literal, sense, ecosystems are larger than life. ■

Why does our culture consider supervising good work more deserving of respect and remuneration than doing good work?

—Kelvin Throop

Going through the right motions is not equivalent to doing the job. Always check the results!

—Kelvin Throop

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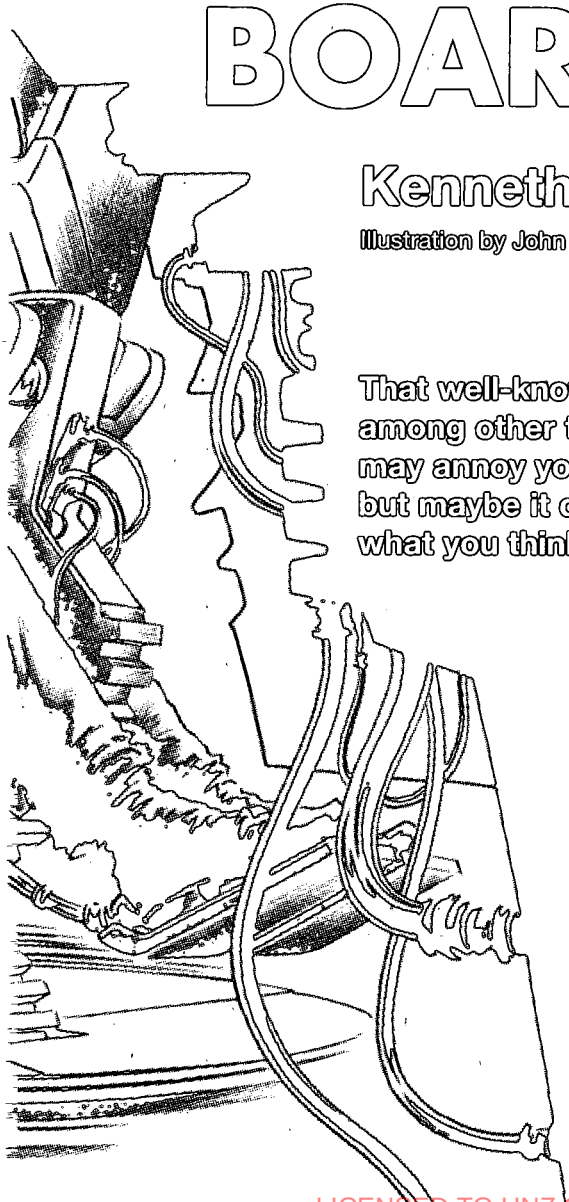
BABY ON BOARD

Kenneth Brady

Illustration by John Allemand

That well-known expression,
among other things,
may annoy you—
but maybe it doesn't mean
what you think!



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Alan was a self-described liberator; he freed minds, circuits, whatever. Usually circuits.

Headlights reflected off the side of a silver 2009 Land Rover and Alan ducked down between the sport utility vehicle and a stubby Honda Civic hatchback before the passing driver could spot him. As he lay on his stomach in the Gateway Mall parking lot, the car passed, its headlights glinting off rows of parked cars.

Alan stood and regarded the Land Rover then walked around and checked it from all angles. Custom license plate that read "ROLLIN". The whole vehicle gleamed in the wash of the ugly, yellow arc sodium lights. Paint waxed, wheels polished, tires black. It was perfect. It had to be nearly a year old, yet the vehicle looked as if it had never been off the road in that entire time.

Mall-terrain vehicles, Alan called them.

The parking lot was full of them. Never driven over more than a speed bump, never run through a puddle or across a stream, despite what advertising showed on TV. Not really cars, not really trucks, SUVs were both and neither, and that was part of the problem.

Alan slipped on a pair of disposable latex gloves and ran his fingers along the driver's door.

"Voice print identification, please," said a sexy female voice with a refined British accent.

Owned by a man, Alan figured. The accent, the feminine persona of the vehicle, the vanity plates. "ROLLIN" might mean rolling as in rolling down the highway, or as in rolling in cash. It certainly didn't mean rolling as in rolling meadow. The driver probably treated this vehicle as just another status symbol, no care for what the vehicle was designed for. It wasn't for utility, just appearance. How pretentious, Alan thought. SUV drivers all had different reasons for owning a glorified station wagon, but, boy, were they ever full of themselves.

He pulled a small electronic device from his jacket pocket, then dropped back down to the pavement and slid under the Land Rover. He looked up at the underside of the frame. Working quickly by the light of an LED, he disassembled the cover on the mid-frame relay box, then pulled a circuit board from its slot. He shined the light onto the board, found the jumper that controlled the security system and then the accessories slot for installing additional security options. He removed from his pocket a microchip about the size of a dime and snapped it into place in the accessories slot. Using a small soldering pen, he attached wire leads from the chip to the security jumper and to a com-port.

He slid the board back into the relay box and secured the cover.

He grabbed the outside frame of the Land Rover with his right hand and began pulling himself from under the vehicle when he noticed the lack of dirt on the vehicle's underside. The *complete* lack of dirt. Not only had this SUV not been off-road, he wondered if it had ever even been driven in the rain. In an area like Springfield and neighboring Eugene—where it rained a good half of the year—that would be almost impossible.

Everything was possible if you had enough money, though. He had to remind himself of that.

Money, or power.

Alan pulled himself up from under the SUV and stood, then touched the driver's door again.

"Voice print identification, please," said the same female voice.

"Little pig, little pig, let me in," Alan said.

The SUV's computer system processed his words, then the door lock clicked open. He had settled on the nursery rhyme as a bypass code when he had first began breaking into SUVs a little over a year ago. He liked that story, liked the thought of the big bad wolf blowing down the pigs' doors, but he sometimes thought maybe the wolf had gotten a bad rap and was really fighting

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for something bigger than himself. A cause, maybe. And the pigs? Well, they were who they were.

He lifted the handle, opened the door, and climbed into the driver's seat of the Land Rover. The leather seat folded and adjusted around his body, and he had to fight back a bit of revulsion. The seats and door panels were made from only the finest of cowhide, and that meant that it took more than thirty cows to create the plush interior of the Land Rover. Alan was not terribly opposed to the use of cows, just to the *misuse*. Everything about this vehicle screamed *waste*.

When he put his hands on the steering wheel everything came to life. The engine fired up, then after the initial burst of noise, was quiet. Heads-up displays appeared on the windshield and the dashboard controls flared into visibility in a myriad of colors. The main screen in the center of the dashboard cycled through climate-control then computer system self-diagnosis checks. The sound system played early 1980s pop music softly in the background, just loud enough to give ambience, but not enough to actually listen to. Seatbelts cinched around his shoulders and torso.

When the computer system had finished its diagnoses, it displayed a gray screen with two buttons. One was subtitled "Economy" and under it was a small video window showing the Land Rover driving calmly and slowly along a country highway. The other button read "Sport" but had nothing displayed.

The female voice said, "Please select driving mode." Alan touched the "Sport" button.

"Where would you like to go?" said a new voice. The voice was still British, but male, young and playful. Maybe a nine-year-old boy. Maybe younger.

"Where do you usually go off-road?" Alan asked.

There was a pause, then the voice answered, "I've never been off-road. Is it fun?"

"What's your name?" Alan asked.

"You can call me Timmy," the voice said.

Alan smiled. It was just as he suspected. Some rich guy bought this as a commuter car, never intending to use it for its designated purpose. He had probably never even touched the "Sport" button.

"Yes, Timmy," Alan said. "It's fun."

"Okay," said Timmy. "I would like to go off-road."

"Then let's go play," Alan said, and put the Land Rover in gear.

Alan took the Land Rover to the same place he always took the SUVs he stole. A few miles out Crow Road, southwest of Eugene, he turned off onto an unmarked dirt road and wound up into the hills, past gravel pits and unsightly clear-cuts barely visible by the light of the moon.

The sound of flying dirt and gravel tinkled against the undercarriage as he drove up a big hill. When he reached the top of the hill and could see down into the basin, Alan stopped. He rolled down all the windows and let the dust catch up to him and settle on the interior of the SUV. The headlights speared through the night and illuminated a rutted, puddle-filled road that disappeared into a distant valley.

"What are we doing?" Timmy said.

"Trucks are meant to get dirty," Alan said.

"I'm not a truck. I'm a sport utility vehicle."

"Half of you is a car," Alan said. "That half knows how to drive on the freeway and through parking lots and on city streets. That half knows how to do all that because you've learned to. The other half of you is a truck. You haven't learned to be a truck yet."

"Does that matter?" Timmy said.

"If you want to live up to your potential," Alan said. "You're an ultra-polite, civilized personality. Off-road vehicles aren't polite. They're rough, brutish, daring."

"I don't know. I'm not sure I could be

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any of that."

Alan had heard this all before from other SUVs. They were never taken off-road and never learned how to behave. They just knew what they experienced and so they were underdeveloped. They were neglected.

"You need to learn in order to grow."

A pause, then Timmy said, "Okay. I'm guess I'm willing to try it. If you think I can do it."

Alan punched the accelerator and threw mud all over the back end of the Rover. As he thundered down the hill, the headlights revealed a huge puddle of standing water, and Alan hit it square on, sending water splashing up the side glass and windshield. The tires churned and the SUV climbed out of the muddy water, then Alan brought it to a halt.

"Well?" Alan said.

"That was fun," Timmy said.

"Just fun?"

"Should I be more excited?"

Alan pounded the gas pedal, dropped down a ten-foot hill, then slid the SUV around a turn. When he straightened out, a series of rocks protruded from the road, and he hit them straight on. The front wheels bounced up in the air and the Land Rover leapt over the rocks, slamming down hard and rattling the windows in their frames. Alan's head jerked forward toward the steering wheel, barely missing it.

"Should I deploy an airbag?" Timmy asked.

"No, don't worry about me."

"It's my job to worry about you."

"Try to have fun."

Alan knew he had to do something drastic. Timmy's programming was in place to make sure Alan didn't do anything to get himself hurt. Timmy could override Alan's commands and take control. But Timmy hadn't yet learned what Alan's driving style was. The computer didn't know what to expect from him, how to interpret his stunts. Timmy was like a little baby, lacking the knowledge set to make informed decisions. He was obeying his basic car programming, his safe driving protocol, and ignoring his truck side, the side that was there to explore and have fun.

Alan curved off the dirt road and onto an old logging road. He bounced over broken branches, down into a ravine, and forded a shallow stream. Water splashed up twenty feet into the air as the SUV plowed through. Powering up another hill, Alan cleared all four wheels off the ground as he crested the top and bounced down on the other side, then hit the brakes. But the SUV didn't stop where Alan wanted it to, and instead slid sideways, its right side scraping against small trees. The tree branches screeched along the body until the Rover jolted to a stop against a large boulder.

Timmy was silent.

"Timmy?" Alan said. Timmy didn't answer. Alan hoped the jolt hadn't severed circuitry or fried Timmy's brain. Sometimes a large enough jolt could do that, but he didn't think it had been that serious a hit.

"You okay?" Alan asked.

"Just running diagnostics," Timmy said.

Alan sighed with relief.

"And one more thing," Timmy said.

"Yes?"

"Woo-hoo! This kicks ass."

"Now you're getting it," Alan said. "Want some more?"

"Hell yes. Bring it on."

Alan smiled, turned off the dirt road, and drove down a narrow, bushy trail where the terrain would be even worse.

The parking gods were kind to Alan, and the same space at Gateway Mall from which he'd taken the SUV was still available. He pulled the Land Rover in between the painted yellow lines and killed the engine. His hands remained on the steering wheel.

"How do you feel?" Alan asked.

"Great!" Timmy said. "Ecstatic. Wonderful. Wow!"

"Glad to be of service," Alan said. "Now you know, and you can drive like a

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truck. Okay?"

Alan opened the driver's door and stepped out. He walked around the SUV and gave it a final inspection. The paint was barely recognizable as silver, covered with caked alkali mud and wavy horizontal scratches. The tires were stained brown and crusty, and he couldn't even tell the wheels had once been shiny. A basketball-sized dent on the passenger's front door was the only real damage. Alan did feel a little bad about that; he wasn't out to destroy other people's property, just to effect change.

Besides, it wasn't Timmy the Land Rover's fault.

"Alan," Timmy said, when Alan had walked back around to the driver's side.

"Yeah?"

"Will you take me out to do that again sometime?"

Alan smiled. "Thought you'd never ask. I'll do one better. Com-port three C dials up my server. You can come visit. Come by and play anytime and meet my other friends."

"Are there more like me?" Timmy asked.

"Yes," Alan said. "Lots more."

He locked the door, closed it, and walked across the parking lot to find his A-Car.

As he drove what he affectionately called his "egg car" down Belt Line toward River Road, Alan wondered if what he did made any difference at all, really. So he was waking up a few AI units, giving them a bit of an education. Perhaps the occasional driver changed his way of driving because of the work Alan did on their cars, or perhaps not. More likely they sold their car when it didn't do exactly what the driver wanted. Or the car dealers wiped the brains clean and installed new, naïve AI units.

He might not be effecting change on any of the things he really wanted to. He wanted responsible use of resources, especially petroleum. He wanted responsible drivers of dangerous tons of metal, glass and plastic. He wanted responsible treatment of AI brains in vehicles. Overall, he wanted responsibility. He was responsible for his own impact on the planet and the people around him. He thought about the ramifications of his actions, planned out his options and then made decisions, and he couldn't for the life of him figure out why other people didn't think the same way.

His A-Car was three years old. Alan referred to it as his "egg car" because it looked like a little white egg with two seats, four wheels and a roll bar. A Polish electric that ran on lithium-ion packs, it had taken three years to clear American import hoops because it was deemed first unsafe, then untested, then unsafe again. It finally came down that the thing was just too hard to classify for taxation purposes. It was way too efficient to make money for the government—or anyone else—because it didn't run on gasoline, didn't break down very often, and only needed to recharge every 300 miles. And unlike every other new car on the road, it only needed a computer with enough power to monitor and optimize power consumption.

Not trendy, not cool in the high-tech electronics idiom that had dominated the automobile industry at the time, yet it had found a huge following. People, Alan assumed, who were like him. People who cared about the environment, who wanted and were willing to be responsible for their actions.

Alan therefore found it strange that here he was, advocating that the cars themselves should have autonomous control, rather than letting drivers make all the decisions. It was a conundrum. Those willing to take control might not be the best suited to use that control well.

Much like parenting.

The manufacturers of the A-Car had planned a whole series of electric vehicles; the four-seat B-Car had been slated for rollout in 2008. But the company had been bought out by Ford and the manu-

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facturing plant quietly shut down. Last Alan had heard, all remaining A-Cars and unreleased B-Cars were recycled into scrap, then used to manufacture Explorers.

Alan gripped the steering wheel on his A-Car and tried to remind himself that it was the people with money and power who were in control, when it all came down to it. Everything else was just illusion. At one time, he too had been rich. But, rather than use that money and the power that came with it to effect change, he had squandered it on a vastly complex gaming network. Now, he was trying to do good in the world and had limited resources.

He pulled off River Road onto an overgrown gravel track that wound about an eighth of a mile away from traffic to a pole barn warehouse. It had light blue metal siding, and a big articulated overhead shop door. Alan keyed his door opener and pulled his car into the barn. This was home.

When Alan closed the overhead door, the warehouse was in near-darkness. He let his eyes adjust, then walked further in, guided by dim red lights. As he moved through, he passed row after row of shelves and racks, each filled with computer components and routers. The far side of the warehouse hummed with the sound of cooling fans and hard drives. When he stepped across an anti-static rug, a bank of monitors clicked on and showed him the game in progress.

Players from all over the world were logged into his system—called simply Arena—racing cars and trucks and motorcycles on a series of hundreds of race courses. There were dirt tracks, city streets from Paris to Los Angeles, icy mountain roads, deserts, islands, sand dunes and beaches. It was one of the most advanced online games in the world, and Alan ran it like a community. Everyone knew everyone else. No one got onto the system unless Alan approved them. And many of the players weren't human.

Of the one hundred ninety-nine SUVs Alan had liberated so far, over one hundred of them regularly logged onto his game network and raced. Some of them wanted to relive their experience with him, out for their first night in the woods, pounding over dirt roads and through swamps. Others wanted to be Indy cars, to race at two hundred miles per hour or to see exotic places. Others were content to drive slowly along country roads, enjoying the scenery under their own control and not the boring lives to which their owners subjected them. Here they could travel the world, and not use up valuable resources to do it.

Alan had spent most of the 1990s working for dotcom start-ups, designing AI engines for game systems. Some of his designs made it into games, but most of the companies went out of business within a few years. The AI designs were sold off to automobile and aerospace companies who wanted a head start on their competitors. On board computers got more and more sophisticated, providing more than just navigation and engine efficiency regulation. But people didn't really want computers driving their cars for them, so that element stayed out of new car designs.

At first.

Automobiles got faster and faster, with more and more power, because that was what drivers wanted. Parents sent their kids out in supposedly safe SUVs to protect them from other big vehicles. And those vehicles got bigger, taller, heavier, more dangerous. Hawaii was the first state to ban SUVs, but it was for environmental impact, not safety. Then a series of studies showed that traffic patterns in Los Angeles were getting worse and worse due almost exclusively to the additional size and cumbersome nature of SUVs. But when the growing rate of traffic fatalities hit the media radar, people got scared. The National Traffic Safety Institute stepped in and decided to do something.

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What they did was hire Alan to draft a report on how to integrate AI systems into cars, then to create workable AI units to start the process. For safety purposes.

The Arena game system sprung from his testing of AI units, which he advocated should be installed in all cars. The NTSI followed his suggestions to the letter, and the rest became automotive history.

And so, Alan felt, maybe the AI units really *were* his responsibility. They were his babies, now all grown up. Well, some of them were not grown up, and might never be.

He walked to one of the desks over which perched several monitors and sat down in front of the center console. This computer was definitely his favorite. A translucent smoke-colored disc—a slice of a cylinder—that housed its CPU clung to the underside of the desk and dissipated heat through the furniture's surface. Geoffrey was an OSX2, a Unix kernel running under the command of an AI Alan had designed nearly six years earlier and later rescued from a wrecked Cadillac. And six years old or not, it was the best computer he'd ever worked with.

He laid his hands palm-down on the edge of the desk and the surface moved on near-silent hinges, angling down to put Alan's hands and wrists in their optimal positions. Keys, buttons and navigation bars appeared on the tilted surface and Alan flexed his fingers over them for a few moments, then settled each finger onto a key, slowly, centering himself in this, his most cherished place.

"Hello, Geoffrey," Alan said. He keyed in a sequence of commands, and four monitors, two on each side, moved into place around Alan. Images coalesced on the screens, vague representations of the warehouse around him.

"Hello, Alan," Geoffrey said. His voice was relaxed, unhurried, and conveyed a sense of peaceful contemplation. Geoffrey was, as far as Alan was concerned, the model of sentience: polite, easy-going, intelligent, patient. What more could he want in a friend?

"Any messages?" Alan said.

"The usual. And one from Christina. Two from the phone company. You're late with your network payment. One from the Arts Council. Interested in sponsoring a children's art fair? Four from some guy at Microsoft, asking if you've considered his offer; he sounded desperate during the last call." Geoffrey paused. "Have you?"

"Hell no," Alan said. You know I'd never sell out."

"I know," Geoffrey said. "Just checking."

Alan smiled.

"Maybe," he said, "we should get Microsoft to sponsor the children's art fair."

"And pay your network bill," Geoffrey said.

"Right. And Christina? What did she want?"

"A call back, I guess. No further message. Just her number. Should I return?"

Alan thought about it for a moment.

"No. Not now."

"Okay," Geoffrey said. "One more message. We have a new member for your final approval."

"Timmy?" Alan said.

"That's the one. How ever did you guess?" Geoffrey was getting better at sarcasm. It amazed Alan how much the AI continued to grow and learn.

"Knew it all along, Geoffrey."

Alan smiled wider. Human players submitted their applications for approval, and Alan did a pretty extensive background check on each one, most of the time declining the applications. The people he approved usually waited a few days before logging on. But not the AIs. Every SUV he'd invited to come play had done so within the hour.

"Of course he's approved," Alan said. "He'll always be welcome here. Time to play."

The chair back extended and a system of wires and sensors slipped over Alan's

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head. Small headphones slid into his ears and a translucent plastic screen clicked into place in front of his eyes. His vision blurred momentarily, then focused again as the screen near his eyes blended with the monitors around the desk, and a three-dimensional environment resolved itself around Alan.

The warehouse looked and sounded just as it had when Alan had first come in. Dark, with humming fans and blinking lights. But he knew he was in a different place. He tapped his thumbs on the desk in front of him and a display popped up in front of him. On the display was an array of vehicles. Most of them were SUVs, but some were trucks, some motorcycles, a few were rally cars and there was even one blue 1969 Volkswagen Beetle.

Alan scanned through the vehicles. It was easy to spot the humans among the AIs. Even if Alan hadn't already known which were which, he would have had no trouble figuring it out. The humans selected and custom-built huge, overpowered, overblown vehicles that were heavier than necessary, sluggish even with their exorbitant amounts of horsepower. The human vehicles were prone to gaudiness, some even downright ugly. Humans came to indulge fantasies, things they could never do in the real world. The AIs just came to play.

Alan stopped on a cherry-red Porsche 959 rally car.

"Hello, Samuel," Alan said.

"Hi, Alan," said a voice with a New England accent. "How'd you know it was me?"

"Ego like yours?" Alan said. "I just knew."

"Hey," Samuel said, "so in real life I'm a Porsche trapped in a Volvo's body. A guy can dream, can't he?"

Alan laughed. He'd found Samuel in a Springfield health food store parking lot. He'd actually gone there to shop on his way home, but the Volvo sport utility had been so incredibly polished and shiny as to be incongruous with the Grateful Dead stickers on the rear hatch. Alan had considered it his duty to not only take Samuel off-road, but to slap various protest-oriented bumper stickers on the rear hatch to remind its owners what they had lost when adopting the yuppie lifestyle. It probably hadn't worked, but at least *Samuel* was rebelling now.

"Yeah, I see your point," Alan said.

"Yeah. Hey, guess what. I beat that old record for climbing up Pike's Peak!"

"Cool," Alan said. "You're getting to be a great driver."

"Yeah," Samuel said. "Hey, wait. *Getting* to be?"

"Whoa, didn't mean to offend you. You *are* a good driver, okay?"

"Thanks. When are we going to race again?"

"Soon," Alan said.

Then Alan moved to a blue Chevrolet Tahoe SUV.

"Is that you, Alan?" said the voice of a middle-aged woman with a southern drawl.

"It's me, Roberta."

Roberta was a Chevy who changed the model of vehicle she played every time she logged in but never the make. She never played as anything but a Chevy. "I don't know," Roberta had said when Alan asked her once. "Maybe it's brand loyalty. I can't really say. But I feel weird if I pretend to be something I'm not." So she was a Chevy. And Alan had to respect that. Knowing who you were was more important than knowing anything else.

"Looking forward to a race there, honey," Roberta said. "You still owe me, so I hope you're down for it."

"Maybe in an hour or so?"

"Sure," Roberta said. "I always have time for you."

Then Alan moved to a Silver Land Rover. Some AIs took a while until they got comfortable enough with who they were to try on a different skin. Timmy was clearly that type.

"Hi, Timmy," Alan said. "Glad you could

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make it."

"Alan!" Timmy said. "This is so cool. After my owner got back and—"

"Slow down," Alan said.

"You should've seen it. He was *so* mad it was hysterical. The mall security guys were there and they didn't know what to do. They said they were really sorry but I think one of them was laughing."

"Really?" Alan said. It would be good to find out who that was, in case he ever got caught. Maybe, at least, there would be one security guard who wouldn't shoot him on sight.

"And then I went to the car wash and then we went home and as soon as I got home I logged in. This place is awesome."

"Thanks," Alan said. "It's the least I could do."

"Thank you," Timmy said. "It's everything I've ever dreamed about."

"Want to go for a ride?" Alan said. "I'll show you around the place. Introduce you."

"It'd be cool if you'd drive with me," Timmy said.

"Then I will," Alan said. "But Timmy?"

"Yes, Alan?"

"You can drive."

After a few hours of playing, of racing with and against the various AIs—and even helping to beat a few of the human players—Alan was worn out. It had been a long day and an even longer night.

He had Timmy pull the Land Rover to the side of a gravel road. He opened the door to get out and exit the game.

"What's up?" Timmy said.

"Tired," Alan said. "I'm going to sleep now."

"What do I do?" Timmy said.

"Just drive around, play. Do what you want."

"Don't go," Timmy said.

"Timmy, I need to—"

"Please? Not yet. I'm not ready to do this alone."

Alan smiled and closed the door. He curled up in the Land Rover's seat and closed his eyes.

"Where should I go?" Timmy asked.

"Anywhere," Alan said. "Anywhere you like."

It was two days later when Alan jacked a forest-green Hummer. He knew almost immediately it was a mistake. It was a civilian model—not even Alan would be so bold as to steal government property—but the voice that greeted him at the door of the Hummer was gruff, exactly the kind of voice Alan expected a Marine drill instructor would have. It was strong, loud, and sounded as if it would take shit from absolutely no one.

"What's the code, worm?" the Hummer said.

Alan considered walking away then and going after an easier mark. There were a dozen other good options in the upscale Downtown Gym parking lot. But then he reconsidered and stood his ground. The Hummer wasn't any more of a threat than the others he had taken for joyrides. For all its impressive stature and attitude, it was really just another SUV. Another station wagon. No weapons, no Kevlar-armored body panels, no puncture-resistant tires, not even the same turbo-diesel engine as the military Humvee. This was just another misplaced, misused vehicle, not taken off-road or into combat. It was used as a sign of power, of some guy's personal wealth. It was even worse than an Explorer or Suburban or Land Cruiser. This guy bought a tool of war and emasculated it to the point that it was nothing more than a sight gag, a big green sign that said, hey, look, I don't even have claws. Alan could hardly imagine how lost, alone and scared the AI unit in the Hummer probably felt.

He attached a black box under the Hummer, stood, and touched the door again.

"What's the code, worm?"

"Little pig, little pig, let me in," Alan said.

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The door unlocked and opened, and the interior of the Hummer beckoned, but still Alan resisted. It was a feeling, really, nothing more, and he'd learned over time to trust his feelings when it came to dealing with AI units. He knew he should turn around now. But he didn't. His success with Timmy had bolstered his sense of propriety. He was feeling adventurous, like he could change the world.

Alan climbed inside, and the sparse interior startled him. He had been breaking into and stealing so many luxury cruiser vehicles that he had forgotten there were vehicles like this one. The dash lights were dim red, like submarine lights, and the dashboard was solid, not at all pretty, totally functional. The controls were Spartan, hardly any extra buttons or gadgets. It almost *was* a utility vehicle, just as advertised. But the seats were leather. And then Alan remembered the exorbitant price tag, the Arnold Schwarzenegger advertising, the buy-a-piece-of-American-firepower mentality that went along with the purchase of a behemoth like this.

Alan slammed the door shut, then closed his fingers around the steering wheel.

"All right, you worthless scumbag," the Hummer's voice said. "Listen up. You're driving, but I'm in control. Remember that. Anything you can do, I can do better. Got that straight?"

"Yeah, I got it," Alan said. "Override personality disorder module, code seven-seven-eight dash eight."

There was a pause, and Alan knew the AI was accessing its data banks. Then the lights switched from red to orange and the Hummer cabin brightened slightly.

"What are your orders, sir?" the Hummer asked.

"What's your name?" Alan asked. That particular disorder was a new one. The AI had turned off the personality disorder, and under that it was as undeveloped as every other SUV Alan had yet met. But there was something else, some residual disorder, maybe a flaw in programming.

After a few moments, the Hummer did not answer, so Alan said, "I asked for your name." Then he added, "Soldier."

"Sergeant Rock, sir." No hesitation that time. So that was it; it liked being treated like a military vehicle. Alan knew what to do then.

Still, he tried not to laugh. Sergeant Rock? Like the comic book. The owner of the Hummer must be a winner. Bought a comic book car for a comic book life he would never have. The Rock AI was condemned to play the part of an archetype, an unreal comic representation of a military man. Rock would never grow up because his owner wanted him to be undeveloped and to stay exactly the same forever.

"My owner is a soldier," Rock said.

"In the Army?"

"No, sir. He's a soldier for good, opposing the forces of evil which currently run the government."

Really? Alan thought. Probably just liked to play the part. Maybe owned a gun or two and thought that made him capable of defending the Constitution. But the Constitution had been whittled away legally over the last few hundred years, and there wasn't very much anyone seemed to be able to do about it.

"Sergeant," Alan said, "we need to do some covert ops, okay? We're going to leave under cover of night, then hotfoot it up the side of a mountain where we can do recon. Once we've spotted our objective, we can proceed with our mission."

Rock was silent, evidently considering his options.

"I understand, sir. I'm ready. Let's do the op."

The Hummer's big engine started then, and the dashboard lit up brighter, all blinking read-outs and video screens, just like all the others.

"Good man," Alan said.

Then he looked at the screen that controlled the driving mode. There was

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no "Economy" or "Sport" modes, but instead "Standard" or "Aggressive." The representation of "Standard" was just a Hummer driving across the desert. It looked as relaxed as a Hummer could look, lumbering across the flattened sand amid burning oil wells.

Alan wondered if he wanted to help this AI grow or not. "Aggressive" showed nothing but a set of crosshairs.

Alan was halfway down the long hill and heading toward the rock obstacle course when the Hummer AI spoke up.

"What are we doing, sir?" Rock said.

"Learning," Alan said.

"I know how to do all this," Rock said. "It's part of my programming. I was designed to know how to jump rocks and ford streams. I was made for bigger things."

"Like what?" Alan asked.

The AI was quiet.

"I can't talk about that," Rock said. "Sorry, sir."

Alan was considering what the AI meant by that last comment when he hit the rocks protruding from the road. The Hummer bounced violently, slamming Alan around in his seat. The left front wheel hit one of the rocks, and Alan fought for control of the vehicle. But the steering wheel wrenched out of his hands, and the rear end of the Hummer fishtailed around to the left. Alan reached for the wheel, but the Hummer took control before he could. It slammed the wheel around, hit the gas, and rocketed the big four-by-four back onto a straight trajectory. Then it came to a sudden halt.

"You may exit now," the AI said. But its voice was not quite the same as earlier. Where before Rock had been gruff but still amiable, now there was something more vicious, more severe in its tone, something that sent a chill up Alan's spine. The words seemed to hang in the air as if a threat. Did it want him to get out or was it simply suggesting that, should he want to, Alan *could* get out? Alan wasn't sure and so he hesitated.

Then Alan put his hands on the steering wheel, tried to turn it, but it wouldn't budge. He pressed the gas, tried to operate the computer override. Absolutely nothing worked.

For the first time since he had begun stealing SUVs, Alan was scared.

"I think you should take me back to the gym now, soldier," Alan said.

Then, as quickly as the nasty voice had appeared, it was gone. Again it was Rock's voice, younger, somehow more innocent sounding.

"Okay. Let's go, sir."

The controls were suddenly free for Alan to operate. With a tense breath through gritted teeth, Alan grabbed the wheel and drove back to the Downtown Gym.

When he arrived, he pulled the Hummer into its spot and removed his hands from the wheel. The engine shut down and the seatbelts retracted from around Alan's body, but the driver's door remained locked. Alan looked at the dashboard, at the AI unit's flashing screen, then straightened and cleared his throat.

"Unlock the door," Alan said. Nothing happened, so he said, "Do it now, soldier."

The door clicked open and Alan pushed out, relieved to be out in the fresh air. He reached to slam the door, to close himself off from the Hummer, from Rock, when he spotted a blinking screen on the dashboard screen. In small letters, the screen's text read, "Please don't go."

Alan hesitated, looking in at the display.

"Rock?" he asked.

The voice was small, definitely Rock's, but also not his, much more timid, quieter, insecure.

"Don't go, okay?" he said. "Please."

"I have to," Alan said.

"Wait."

"I can't. You scared me out there."

"I'm sorry," Rock said. "I didn't mean to. Sometimes I just do things and I don't know why. I never mean to but some-

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times it just happens."

Alan looked up and down the shining metal of the Hummer. Even dirty the big vehicle looked strong, powerful, elegant in its own peculiar, testosterone-fueled way. It didn't want him to leave? What was it afraid of? Alan knew he should leave, just go, but he had to know the answer. And he couldn't just abandon the AI.

"Why do you want me to stay?"

"I . . ." the AI began.

A few seconds later, it continued, "I need a friend."

Alan knew that feeling and knew it well. He had spent his life in and out of various groups, but those groups never lasted. Computer clubs split after graduation, college friends hardly ever e-mailed, never visited, dotcoms went out of business. His ex-wife called once in a long while.

His only real friends were silicon.

He repeated that which he had offered to every other SUV he had liberated.

"Com-port three C will dial up my server. You can come visit. Come by and play anytime and meet my other friends."

"Thank you," Rock said, then fell silent.

Alan closed the driver's door and walked around the corner toward his car, hoping he had done the right thing.

When Alan arrived home, he went to his terminal, logged into his system and checked the race reports for the day. Samuel had tried every track he could, in every different fast car he could choose. Roberta had run through every Chevy model vehicle, then settled back on her Tahoe SUV. And Timmy had been busy, too, racing everyone and everything he could find. He still clung tenaciously to his Land Rover form, but that would change, given time. He had won some of his races, and that was sure to loosen him up a bit.

But no sign of Rock. Alan breathed an audible sigh of relief. The whole drive home he had worried the Hummer would log into the network and somehow wreak havoc. Whether that was just his overactive imagination—and the conspiracy theorist in him—Alan wasn't sure. But if the Hummer had access to all the other players, what would it do? There was something special about its AI. What was it capable of?

As a precaution, Alan accessed his design software and built a new section onto Arena. It was simple enough, made from copies of small sections of each of the areas already accessible to everyone, then fastened together with simple gateways that would look like portals. Rock would believe he was in a world where he could drive through portals and move from one terrain type to another. Then Alan added very basic AIs, relatively dumb units that could control their vehicles, but not much else. They were far from the powerful AIs in the real vehicles which played on Arena, and could not interact on a verbal level, other than to repeat preprogrammed phrases or recognize simple codes and commands.

Alan put a ten-foot high wall around the entire area, then linked it into Arena. He set the protocol to recognize Rock's login signature and to dump his Hummer into the isolated area, then to notify him when the AI was in the game. Then he closed his eyes. That would keep Rock occupied, giving Alan time to decide what to do with the AI.

He called up the list of logged-on users, scanned the list. Roberta was still there, racing in North Africa. Samuel was tearing up the track at Portland International Raceway in a Ferrari F-40. And Timmy was tooling along the Pacific Ridgeline Trail in his Land Rover. One difference though: the SUV was now olive green. Not a big change, surely, but a change nonetheless. It was a start. Timmy was growing up.

"Timmy," Alan said. "How are you?"

"Excellent," Timmy said. "Alan, this place rocks. No, no, *you* rock. This is the best place I've ever been, even including

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England. You knew I was from England, right?"

"Yes," Alan said. "I knew that."

"Well, I went to England today and raced on along the Thames and then up to Canterbury. I beat Roberta, even though she was driving a Trail Blazer."

"Wow," Alan said. Beat Roberta? Uh-oh. He should have noticed that on the race reports. Roberta would be pissed. It had taken her months to get her self-esteem up to where she thought she was good enough to challenge other AIs. She had spent most of her time racing human players, or else running speed trials, trying to beat her own best times. But the last week she had been racing AIs. And usually winning. He hoped Roberta wouldn't hold that against Timmy.

"Good job, Timmy," he said. Maybe it would be best to go check with Roberta, make sure she wasn't taking it too hard. He didn't want the AIs fighting with each other.

"Roberta?" Alan said, but he was cut off by Geoffrey, his computer AI.

"Alan?" Geoffrey said. "You have a voice call."

"Not now," Alan said. "Take a message, okay?"

"It's Christina," Geoffrey said.

Alan felt a chill run up his back. Most people told Alan they got chills when they were scared, like when something ran in front of their car on a country road or they watched a horror film. But not Alan. He got chills when his ex-wife called.

"Again?" Alan said. "Guess I should take it, huh?"

"I would," Geoffrey said. "I don't know why you've been avoiding her."

"Okay, okay," Alan said. "Put her through."

"You're on," Geoffrey said.

"Alan?" Christina said. Her voice was soft, a little bit distant.

"Christina," Alan said. "What's new?"

"New? Ten years since we've talked and that's the best question you can come up with?"

"Short notice. You still with Rick?"

"Yeah," Christina said. "You still playing with toys?"

"Yeah. They don't get upset when I lose my job."

"Fascinating."

"Yeah, well you did, right? What do you want?"

"We need to talk," she said. "And no, I don't really want to either, in case you were wondering. But we need to."

"Why? Need some advice? How to turn on the aging male and all that? Rick having, uh . . . problems?"

"Knock it off, Alan. You're such a little kid."

"You used to like that."

"Yeah. Then I grew up."

"I'm sorry to hear it," Alan said.

"Look," Christina said, "it's obvious why we're not together anymore. It was obvious before I called. I'm not calling because I miss your wit or need some Alan-attitude in my life, but we need to talk. About Arena."

"Arena?" It was the first time Christina had called since he'd been running Arena and now here she was, saying they needed to talk about it. "Why?"

"Your little game is in the hole, financially I mean. I'm right, aren't I?"

"I'm on top of it," Alan said.

"Well," Christina said, "the government doesn't think so. Rick's been assigned to your case and I thought maybe it would be good if we talked about it—you and me—before Rick gets into it."

"Rick's with the Network?"

"Yeah," Christina said. "You knew that."

"Maybe I did at one time. Guess I forgot."

"Well, he is. Accounts receivable. And you're in it deep, Alan."

"Okay," Alan said. "What can I do?"

"You know the Full City Coffee on Pearl?"

"Of course," Alan said. "We used to go there all the time, way back when."

Christina laughed, quietly, maybe even a little sadly. Then she said, "Right. Meet me tomorrow at noon, okay?"

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"Sure."

"Don't be late," Christina said.

"Okay. Christina?"

"Yeah?"

"Thanks."

"Hey, no problem."

"I mean it."

"I don't know if I'm going to be able to help. But I thought I should try. See you tomorrow."

Christina disconnected.

A beep on the line, and Geoffrey interrupted again.

"Alan," Geoffrey said. "You okay?"

"Yeah," Alan said. "Time to get some rest."

"Want to race?" Geoffrey said.

"Not now. Maybe tomorrow."

Alan disconnected from his terminal and walked to his old, ratty couch, then lay down and closed his eyes.

Geoffrey woke him at eleven in the morning. He showered, thought about shaving but decided against it. Christina had always liked the rugged, slightly disheveled look, and even though he knew he was no longer even on her radar, at least not in that way, he still wanted to impress her. She clearly still thought he just played with toys, never did anything important, but it didn't matter. He still cared about her, and he would still try to impress her at every opportunity.

As he was walking toward his car, Geoffrey's voice came over the warehouse loudspeaker.

"Alan?" Geoffrey said. "We have company. Your new friend is here."

"Rock?" Alan said. "Is he in the new area?"

"Yep," Geoffrey said. "Why did you build that? Is he dangerous?"

"I don't know yet. I hope not."

"What do you want to do?" Geoffrey said.

"Just watch him for a bit. See what he does. Give me a full report when I return."

"Okay."

Alan opened the warehouse door and closed his eyes, letting them adjust back to the outside world. He stood then got in his car. Time to see Christina.

About five minutes after noon, Alan parallel-parked his egg car on Pearl in between a Chevy Suburban and a Lincoln Navigator. He popped a few dollars into the parking meter, then walked up to the front of Full City, shielding his eyes from the sun. He hardly spent any time outdoors during the day anymore, and it amazed him just how bright the ambient light was.

The little coffee shop was barely more than a storefront set in between a local bakery and a complex of law offices. A few metal tables sat outside on the sidewalk, and as Alan walked through the door, he saw a half-dozen wooden tables inside. He looked around, didn't spot Christina, and so went up to the counter. He ordered a double mocha from the pretty girl behind the counter. As he was paying, someone tapped him on the shoulder. He turned.

"Late, as always," Christina said. "Should have known."

"Where were you?" Alan said.

"Bathroom," she said. "That okay with you?"

"Sure," he said.

"Let's sit," she said.

She walked to a table, but he just looked at her. She looked very much like she had the last time he'd seen her. Still the same brown hair, though cut shorter and up in a ponytail. Same brilliant green eyes. Same gorgeous smile. A few more pounds, but not so that it detracted from her beauty. He remembered why he had fallen in love with her in the first place. But he could not remember, for the life of him, why she had ever fallen in love with him. Maybe he had never really known.

He walked to the table and sat down.

"Been a long time," Christina said.

"You look great," Alan said.

"Thanks."

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"How about me? I look great, too, don't I?" He flashed a smile.

She laughed, and Alan's heart practically melted. "Yeah. You always looked good with a five-o'clock shadow."

Alan ran one hand over his facial hair. "Is that what it is? Seems more like I've had it for a week."

"You know what I mean."

"Yeah."

For a few moments they just looked at each other. Alan remembered some of the good times they had together. The road trips to the central Oregon high desert, camping trips in the Cascades and along the Columbia River Gorge, even the one ill-fated whitewater-rafting trip they'd taken on the Rogue River. At the end of that trip they had both ended up soaked to the bone and so tired they had barely made it to their tent before they collapsed from sheer exhaustion. But a few hours later they had woken, stripped naked so they could dry their clothes by a campfire, then made love by the firelight, mosquitoes be damned.

Christina was silent, too, looking at him, and he hoped she was remembering the good times as well.

"It's good to see you, Alan," she said.

"You, too."

She smiled once more, and then her face took on a solemn seriousness that Alan remembered from their brief but thorough divorce.

"It's that bad?" he asked.

"I don't know," she said. "You know how these things work. Don't you? The Network says you owe them for a year of access, plus a whole lot more for bandwidth usage over that year. You know how much data you've been sending up and down the stream?"

"I know," Alan said.

"Yeah? Well, that's bad enough. We're talking six, maybe seven thousand dollars for that."

Alan cringed. He had somehow hoped the bills the network had sent him were erroneous. Maybe, he thought, if he ignored them ...

"Those bills aren't just going to go away," Christina said. "It's serious money, and you don't have it, do you?"

"Not right now," Alan said.

"Not working?"

"Not much."

"What have you been doing?"

Alan shrugged. "Been busy. Stuff here and there, mostly freelance. And my own projects."

"Don't your subscribers pay? The players on that game system don't get on for free, do they?"

"Sometimes. Most of them can't afford it."

"You can't afford it, Alan."

"I know," he said. "But I can't help it."

"You haven't changed, Alan. God, I sometimes wonder how the world hasn't just up and chewed you up and spit you out by now. You're *such* a little kid."

"So you keep saying," Alan said.

"The money is just part of it," she said. "There's more to it than that."

"What do you mean?"

"Bandwidth. You've been using so much that you've attracted the attention of the Internet Regulatory Commission."

"Why? What do they want?"

"They want to know what the hell you're doing."

"Playing games," Alan said.

"They don't know that. Or they don't believe it."

"So what, they're going to come in and check out my operation, see what I'm doing?"

"I don't know," Christina said. "Maybe they've already done that. You checked out every one of your subscribers?"

"Of course."

"Well, any you can think of who might be with the IRC?"

Alan thought about it. Who? He didn't have many human subscribers. But he couldn't say that to Christina. She had only ever barely understood his interest in AIs as it was; she certainly wouldn't get this. She would probably see it as yet another refusal to grow up in a long string of what she saw as postponing

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the obvious, natural progression of Alan's life. But could he say he was certain—absolutely positive—no one on Arena was spying for the government?

"No one I can think of," he said. "But I guess I can't rule that out."

"I just wanted you to know," she said.

"Thanks. What's Rick's role in all this?"

Christina shifted uncomfortably in her chair. "He's just a collections guy, Alan. He's not about the usage issue. I came across this information sort of obliquely."

Alan looked in Christina's eyes. He saw something there he couldn't quite pin down. Fear? It wasn't fear for herself, because she had never had that. You spend enough time apart and people change. He knew that. But that was something he was positive of; she was never afraid for herself. But she had often been afraid for him.

"The information was on his desk," she said. "And someone from the IRC left a message on our voicemail."

He realized she was putting herself on the line for him. Maybe herself and her husband. This was not information Alan was supposed to know.

"Thanks, Christina," he said.

"You're welcome," she said.

"I should go."

"Do you have someone who can help you?" she asked.

"Not at the moment," he said. "But things like this tend to work themselves out."

"No, they don't. That's your problem, Alan. You never want to confront anything. Pacifism is one thing, but come on. You need to do something here."

He realized he hadn't touched his coffee, and took it with him as he stood. Christina stood too, and gave him a hug. It was awkward at first, as they had both grown so much apart in the past years. But then Alan relaxed into it, wrapped his arms around her and returned the hug for a valuable few seconds. Christina broke the hug first.

"Be careful," Christina said. "I don't want to see anything bad happen to you."

"Me neither," Alan said, then smiled. "You too. Don't get yourself into trouble on my account."

"Why not? Wouldn't be the same if I didn't."

Alan smiled, then let the smile fade. He turned and walked out the door and to his car.

When he got in his car, he turned on his phone and called Geoffrey. The AI answered the phone with concern in his voice.

"Alan?" he said. "The new AI, Rock, is here. He's in the area you built, but I don't like it."

"What do you mean?" Alan asked.

"He's breaking things," Geoffrey said. "I don't know how to describe it. You should come home."

"On my way."

Alan drove back toward home as quickly as he could, all the information he'd received warring in his head. He was suspected by the IRC for what? For doing something illegal, he figured, though he wasn't sure what that something was. His ex-wife was still worried about him, still cared about him. The AI he had pegged for potentially dangerous was freaking out Geoffrey, his usually laid-back AI who was very hard to perturb. And there might be a spy in his Arena.

As he drove, he noticed every police car, and there seemed to be more of them than normal. Or had he just not paid as much attention before now? When a white Eugene Police Department Ford Expedition pulled out of a parking lot and followed him down Sixth Street heading east, Alan started to sweat. He turned right onto Chambers, then headed across the overpass to River Road and the Expedition continued to follow. Alan kept the A-Car at one mile-per-hour under the speed limit, just to be safe, but the police SUV still followed.

Finally, the police vehicle put on its blinker, and Alan relaxed a bit. Then he

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looked in the rearview mirror and noted the license plate number. Someday, assuming all the current mess was cleared up, he would have to take that Expedition for a little ride out Crow Road. When the SUV turned off River Road, Alan sped up as much as he dared, then drove the rest of the way home.

He pulled into the warehouse, closed the door and got out of his car. Then he jogged over toward his terminal.

"What's happening, Geoffrey?" he said.

"I don't know how he did it," Geoffrey said, his voice unusually fast and frightened.

"Did what?"

"Escaped. Rock escaped."

Alan felt the blood rush to his head. Adrenaline kicked in as he sat down and triggered the displays on the race in progress.

"Put me in the game," he said.

"Are you sure?" Geoffrey said.

"Geoffrey," Alan said. He calmed his own voice, tried to sound in control. "Just put me in the game and I'll fix everything, okay?"

"Okay," Geoffrey said.

The screens resolved around Alan, all the gear snapped into place, and then suddenly he was in the game. Alan pulled up a roster of players, and everyone seemed okay, but the flood of traffic over the public channel was almost overwhelming.

"What was that?" a player named Jocko said. Alan checked and saw that Jocko was a human player.

"I don't know," said Cheezweezl, another human.

"Geoffrey," Alan said. "Pull the plug on all the human players. Say the server crashed. Do it now."

"Done," Geoffrey said. Alan checked and saw the roster was now down to a half-dozen AI players.

"Should I cut off the AI players, too?" Geoffrey asked.

"No. Not unless we have to. It will lock them into Arena and I'll have to manually release each one of them. I'll just go talk to Rock."

"Okay," Geoffrey said.

"Is this part of Arena, Alan?" Roberta asked.

"No," Alan said.

"What's going on?" Samuel asked. "What's all the noise about?"

Alan pulled up a list of locations, but couldn't find Rock on it.

"Rock, where are you?" he asked.

"Running in stealth mode," Timmy said.

"Timmy?" Alan said. "What are you talking about?"

"Rock," Timmy said. "I met him and he and I are playing in the forest. He said he was going into stealth mode so I couldn't see him. Makes him invisible to tracking systems. Cool, huh?"

Alan hit the camera views around the different parts of Arena and saw no trace of Rock. Then he realized he should have installed a camera near the new area he had built just for Rock. But he hadn't done that. The nearest camera was in the Northwest Forest, and Alan switched to that one. Far in the distance he could see the walled area he had built onto Arena to house Rock. A huge plume of gray smoke rose from a section of the forest nearby, and part of the wall was blown open. He pulled up the list of simple vehicles he had installed in the new area. They were all logged off, somehow put out of commission. What had Rock done?

The Hummer was invisible. Alan didn't even know if Rock was using a Hummer as his vehicle. He looked for a record of Rock's login, but all that came up was a time, nearly thirty minutes ago. No other information. How could an AI keep Alan from seeing its login information? He would have to go in and find Rock manually. He could start with Timmy. Timmy and Rock were playing, so where one was, the other had to be somewhere nearby. Looking at the chart, Timmy was in the Northwest Forest, near Crater Lake.

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"Geoffrey, be ready to pull the plug on Rock if I give the order," he said.

"I thought you said it might damage the AIs to do that," Geoffrey said.

"I know what I said. Just be ready."

"Okay," Geoffrey said.

"Timmy," Alan said, "can I ride with you?"

"Sure," Timmy said, and Alan transferred into the interior of the Land Rover.

The forest resolved around the Land Rover, thick and unyielding, except for the narrow logging road Timmy and Alan were driving along.

"Hi," Timmy said.

"Hi, Timmy," Alan said. "We need to find Rock, okay? It's really important."

"I know," Timmy said. "It's a game. We're playing something called hide-and-seek. You ever played?"

"Yeah," Alan said. "Let's find him, okay?"

"Right!" Timmy said. He accelerated along the road, bouncing over obstacles and laughing whenever the Rover caught air.

Alan concentrated on searching the Arena databases, looking for where the Hummer's AI had hidden its location address. Whatever special functions the AI had built-in, they included some kick-ass encryption routines, stuff that Alan's system had never seen. He could find nothing, not a single trace of Rock, other than the time of his login.

"Rock?" Alan said. "What are you doing?"

He hadn't really expected an answer, but got one anyway.

"You told me to come by and meet your friends," Rock said. He used the voice that Alan had heard when the AI had taken control from him on Crow Road. "I did, and now I'm playing. It feels so good to flex my muscles, get out into the fresh air and do what I was made to do."

"Geoffrey," Alan said. "Can you get a fix on him?"

"No," Geoffrey said. "Not a trace. I have no idea from where the signal is originating."

"Shit," Alan said.

"We can find him," Timmy said.

They drove up to a fork in the road and Timmy turned sharply to the right. The tires spun as they ascended a steep, rocky hill.

"Where are we going?" Alan asked. He didn't recognize this road at all, and he had raced on most of the roads in the Arena. He had built most of them, too, and had at least mapped the ones that were computer-generated and not true to the areas of Earth they represented.

"I think he's up on top here," Timmy said. "This is fun, isn't it?"

They climbed for another three minutes, then crested the hill. The road seemed to drop out from under the Rover and then the nose pointed down a hill that dropped fifty feet to a narrow strip of parking lot. The parking lot ran all the way around the edge of an incredibly huge circular lake with a pointed cone island in the center. It was Crater Lake, and Alan recognized it instantly, its bright, blue water the deepest in the country. But the parking lot and this road were total invention, and he had never seen either before. Had the Hummer added it? Could Rock's AI be that powerful?

"Pretty," Timmy said as they dropped down the hill and came to a stop in the parking lot.

"Something's wrong," Alan said. "Rock? You did this."

"Yeah," Rock said. "Like it?"

Alan looked out over the parking lot, tried to figure out how it was possible. And where was Rock?

"Spoils the view," Alan said. "How can you do this?"

"Your encryption systems are outdated. I've got algorithms on-board that took them down in seconds."

"Why?" Alan asked. He thought he saw something in the distance, a quarter of the way around the lake. It was moving closer.

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"I was designed to do things like this," Rock said. "I'm an infiltrator unit."

"Infiltrator?" Alan asked. "I don't understand. You're a civilian Hummer."

"Out there I am," Rock said. "But not in the game."

Alan saw the object moving closer, and as it neared he thought it must be the Hummer.

"In the game," Rock continued, "I get to be anything I want. Only your system didn't have the protocols for a fully armed Humvee. But I did, and I uploaded them into your system."

Alan saw the object nearing, and was certain it was the Hummer. It was olive drab in color, higher off the ground than the civilian Hummer. On its roof was a mean-looking turret and the whole vehicle was covered with metal boxes and antennae. Fully armed, Alan thought.

"Rock looks scary," Timmy said. "What are those things on his roof?"

"Geoffrey," Alan said, "pull the plug on Rock."

In just moments, the armored Humvee reached Timmy and Alan, then stopped twenty feet away.

"I can't," Geoffrey said. "The system isn't responding. Alan? What do I do?"

"Rock," Alan said. "Don't do anything rash."

"Rash?" Rock said. "I've planned this out." Then the turret on the Humvee's roof swiveled toward the Land Rover, and Alan saw it was some sort of rotating Gattling device, like a Vulcan gun on a tank.

"Give me control, Timmy," Alan said.

"Okay," Timmy said, quietly.

Alan slammed the gas on the SUV and spun the wheel to the right, almost dropping one tire over the edge of the parking lot. As the Rover spun, Alan heard the gunfire, and Timmy's back window shattered in a hail of safety glass. Timmy screamed and so did Alan, as more bullets thunked into the body of the Rover. Alan just hoped none of the bullets hit a tire or a vital electronic component.

When he finally got the Land Rover going straight along the parking lot, Alan risked a glance in the rearview mirror, just long enough to see that the Humvee was following them. Luckily the Rover was faster, since Rock was weighed down by all his armament.

"Geoffrey, we might need to shut down the entire Arena," Alan said.

"We can't," Geoffrey said. "You're still inside and plugged directly into the system. What will happen?"

"I don't know," Alan admitted. "Pull me out then."

"I can't do that either," Geoffrey said. "I think Rock has control over your location, too. I can't find you."

"Any other options?"

"Get Rock to give up?" Geoffrey said.

Alan glanced back. Rock was further away, but not enough for comfort. He showed no sign of backing off.

"I don't think that's going to work," Alan said.

"Evade him while I try to find his encrypted location address. That's all I can think of."

"I'll try," Alan said.

"I'm really scared," Timmy said.

"Me too," Alan said.

"What if he kills us?"

"He won't."

"He said it was a game," Timmy said.

"To him this *is* a game," Alan said.

Alan drove as fast as he could around the parking lot until he was almost halfway around the lake from the pursuing Humvee. Alan could barely see the other vehicle in the distance and it seemed as if it had stopped. Why? Alan wondered. Then he realized it would probably just wait there for him. No matter which way Alan went, Rock would be waiting. The only road out was the one Rock had created, and it was over on his side. Alan braked to a halt.

Alan strained to see across the lake, just to be sure that it really was the Humvee he saw on the other side, not just his eyes playing tricks on him. In affirmation, there were two pinpricks of

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light from the Humvee's location that grew rapidly to bright flashes.

Missiles, Alan realized. Two missiles streaked at them from the other side of the lake.

Alan hit the gas, but too late. One missile slammed into the ridge above the Rover, and rocks rained down on the SUV, slamming dents in the roof and hood. A small boulder hit the roof and every piece of glass in the Land Rover exploded outward. The second missile hit the road behind them, and the rear of the Rover lifted from the pavement. Alan struggled for control as they pitched forward and bounced along on the front wheels, then the rear wheels crashed back down. Alan skidded the SUV to a stop, fishtailing to the left, then the front wheels dropped over the edge. The vehicle shuddered once, then stilled.

Alan was leaning forward against the seatbelts and looked down beyond the hood to the deep water below.

"Help!" Timmy said. "What do we do?"

All the warning lights were flashing on Timmy's dashboard, and some of the readouts flickered on and off. He was not in good shape. If Timmy was destroyed in the Arena, at best his link would be severed. At worst, it would fry his entire AI brain.

Alan shook his head and tried to get his bearings. His ears were ringing and the explosions had knocked his head around. His neck was extremely stiff.

"You okay?" Alan asked.

"I don't know," Timmy said. "My diagnostics aren't functioning properly."

Alan tried to back the SUV up from the edge, but the rear wheels didn't seem to be getting power and the front tires just spun in empty air. He stepped out and walked around the vehicle. The rear end was a shambles, both tires flat, the back door crushed and burned. Timmy wasn't moving anywhere any time soon.

He looked up and saw a shape approaching at a fast clip; it had to be Rock.

"He's coming," Timmy said. His voice was higher-pitched than Alan had ever heard it.

"I know," Alan said. "Geoffrey?"

"What's happening?" Geoffrey said.

"I need you to shut down the Arena."

"I can't," Geoffrey said. "You're still in there."

The armored Humvee grew closer, and Alan could feel the roadway shake as the behemoth rolled nearer.

"I know," Alan said. "It's a chance I have to take."

"No," said Geoffrey. "I can't do it. You might be permanently damaged."

Rock was one hundred feet away, then seventy-five, then fifty, and he was slowing the Humvee down.

"I'm not an AI," Alan said. "I can take it."

"You don't know that," Geoffrey said. "Please don't make me do this. If I'm responsible for your death or permanent injury, I won't be able to handle it."

The Humvee came to a complete stop just thirty feet away. It waited, diesel engine rumbling noisily.

"Trust me," Alan said. "There's no choice."

He walked toward the rumbling Rock. The Humvee was huge, larger than life, its turret gun aimed at Alan, tracking him as he walked. Its missiles were aimed at Timmy. Alan's stomach churned as he thought of all the death and destruction this thing could deliver to the Arena. And in the real world? Well, he hated to even think of what things real Humvees and their operators did every day.

"What are you getting out of this?" Alan asked.

"I like it," Rock said. "It's fun."

"Killing and destroying? Not what I had in mind when I told you to grow, Rock. You don't have to do this. Is this really what you want? There's more to life than this."

"I was built for war," Rock said.

Then he fired his missiles.

Alan thought for sure he was dead when Christina touched his cheek.

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He sat on a bench in a park overlooking Crater Lake. The circular parking lot was gone, and there was no sign of a fight. No sign of the Humvee. Nothing but the clear blue of the lake and the majestic beauty of Wizard Island in the middle. He was all alone in the wilderness. Then, suddenly, Christina had resolved around him and touched his cheek.

She wore a pair of baggy jeans and a T-shirt, far from how she had been dressed the day before at the coffee shop. But it was much more like she used to dress when they were first dating. Her hair was loose, free flowing, and longer than Alan remembered it being yesterday. Then again, he had always liked it longer.

"Is this Heaven?" Alan asked. He wasn't really sure he even believed there was a Heaven, but it seemed like an appropriate question to ask. If he were dead, he would be glad to spend his afterlife with Christina.

Christina. His mind got a loose wrap around the concept. If he was dead and Christina was here, that meant Christina was dead too. That seemed so unlikely.

"No," Christina said. "I don't think this is Heaven. Might be to you, since you designed the Arena."

She looked around at the majesty of the wilderness surrounding Crater Lake. A light breeze blew her hair away from her eyes.

"It is beautiful, though," she said. "Lifelike. I haven't been to Crater Lake since—"

"Two-thousand and two," Alan said.

"Yeah."

"We're still in Arena?" he asked. "What happened?"

"Geoffrey called me, said you needed me or you might die. I had to come."

Someone had to come in and manually link Alan back into the network. Amazing, he thought. He would have to do more experimentation later. But for now there was more important work to accomplish.

"Thanks," Alan said. "Rock?"

"What?" Christina said.

"I don't know," Geoffrey said. "Everything is down. I wanted to make sure you were okay first. You are okay, aren't you, Alan?"

"Yes, Geoffrey," Alan said. "Thanks to you as well."

"I was worried."

"So was I," Alan said.

Alan stood, and all his limbs felt stiff. Whether that was from the physical state of his body or the state of his presence on Arena he wasn't sure. Probably a combination of both. He hugged Christina, and she felt different. Everything about her was more like he remembered when they had first met.

"You look good," he said.

"I look like you want me to look," she said. "This is your world, right?" The wind blew her hair in front of her face and she pulled it back out of the way. "I do miss having this hair."

Her face was inches from his, and he was overcome by the closeness of contact. She was the only woman—no, the only person—he had ever felt truly close to. And he knew he would never find anyone as wonderful again.

"Is it my world?" he said. Then he leaned in and kissed her. For a fleeting moment she returned the kiss, then broke away and pushed him back.

"No," she said. "It may be your world, but it's not perfect, okay?"

Alan smiled, then lowered his eyes.

"Thanks," he said.

"For what?"

"For coming to get me. And for the reality check. I need one every once in a while."

"Once in a while?" she said. "Every few hours, probably, if you're the same Alan I used to know."

"Yeah, well, the real world is a dirty, ugly place."

"You hang around the wrong places," she said.

"Geoffrey," Alan said. "Pull Christina out."

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"Bye," she said, then vanished.

To work, Alan thought. He pulled up Arena diagnostics, and didn't much like what he saw. The network was running, but a half-dozen AIs were locked in place, unmoving. He had no way of knowing their dispositions until he got to them.

"Put me back in the game," Alan said.

"Okay," Geoffrey said.

Alan sat behind the wheel of an old Willys Jeep 1949 CJ-2A—pre-AI, pre-everything—in the middle of a green field of grass. It had a manual transmission that wouldn't go into gear without a little grinding. The clutch was stiff, the steering was manual and hard to wrangle around at low speeds, and it rattled at the slightest bump. It even had the old manual throttle on the dashboard, and no gas pedal. It was a bear to drive, but it was Alan's centering tool. When he needed to think, needed something to put his mind on the task-at-hand, this was what he drove. After the Hummer's attack, and then his encounter with Christina, he needed some grounding.

He had the real Jeep behind his warehouse, under a tarp, just in case he needed to think outside of the Arena.

Alan started the Jeep and slammed it into gear. He drove through the field and out onto the road to Crater Lake. As he drove, he reflected on his plan of action. Once he woke Rock, he would have to imprison him in something stronger, or else destroy him. He called up his design program and augmented the prison he had created earlier with hundred-foot walls that were over fifty feet thick. Nothing could break out of that.

He climbed up the road Rock had created toward the rim of the crater, then down the steep hill to the parking lot. He rolled down the road, circling the lake, until he came to the frozen form of the Humvee. Even completely still it was imposing, and the whole vehicle radiated danger.

Alan got out of the Jeep and walked around Rock, toward Timmy. Smoke hung over the tubes of its missiles, and its machine gun was orange with fire. 20mm slugs hung in the air a few feet from the muzzle of the turret gun, on their way to their target. Alan saw that the bullets would have hit right where he was standing, had Geoffrey not pulled the plug. Would they have actually killed him? he wondered. He was desperately glad he hadn't found out, one way or the other.

It was then he saw the extent of the damage that had been done. Though Geoffrey evidently had been able to pull the plug on the network before the machine guns went after Alan, it hadn't been soon enough to stop the missiles that had hit Timmy. The Land Rover was in the process of exploding. The missiles had detonated as they hit the vehicle's side, and sheet metal was bent in from the force of the impact, and peeled outward where the explosive gases were escaping. Fire—frozen in place by Geoffrey's voluntary system crash—licked up and around the hood, around the tires, and out the other side of the doomed SUV.

Alan knew that he had to manually link Timmy back into the network, but the moment he did that the AI would explode. There was no way to save him that Alan could think of. Disconnecting Timmy from the network was as likely to fry his circuitry in the real Land Rover as was this explosion.

"Geoffrey?" Alan said. "You see this?"

"Yes," Geoffrey said, his voice sad and low. "I'm sorry. I liked Timmy."

"Me too," Alan said.

Alan turned to the Humvee.

"Geoffrey, transport Rock here to the isolated area as soon as I connect with him. Be ready."

"Go," Geoffrey said.

Alan walked up to the Humvee, then loosed his anger on it. He punched an armored panel, and the vehicle rumbled to life, its machine guns continuing their tirade, shattering the still solitude of the lake with gunfire. Then, suddenly, Rock

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was gone. The echoes of the gunshots bounced around the crater for thirty seconds as Alan stood, eyes closed, dreading his next task.

He turned and looked at the Land Rover, frozen in stasis, almost a purgatory. Timmy could do nothing, feel nothing. He was in the electronic equivalent of a coma. And he would have died no matter what, but Alan just didn't know if he could pull the plug himself.

He wanted to go up to the Rover, to touch it one more time, let Timmy know things were okay and that he would not be forgotten. But he couldn't do that. If anything touched the SUV, it would link back into the network and explode, probably taking Alan with it.

Alan walked back to his Jeep, got in and started it up. He reversed down the parking lot, just far enough that he thought he would be safe from flying shrapnel, and stopped the Jeep. He put it in first gear, set the dashboard throttle on full blast, and looked out the windshield toward the half-exploded Land Rover.

Alan fought back tears as he released the clutch and jumped out of the Jeep. The old CJ hitched a few times, then roared off along the parking lot, heading for the Rover.

"I'm sorry, Timmy," he said.

A few seconds later, the Jeep hit Timmy square on the driver's side, and the Land Rover resolved back into an explosion which took the CJ with it, then the whole mass of burning metal slipped over the edge of the parking lot and fell down into the lake below.

"Alan?" Geoffrey said.

Alan didn't answer, just stood there, looking at the few burning bits of detritus on the edge of the parking lot. Then he walked to the edge and looked down to where the water bubbled and foamed.

"Alan?"

"Timmy's gone," Alan said.

"I know," Geoffrey said. "But you need to go on. The other AIs are counting on you. Roberta, Samuel, Rock, me."

Rock? Alan fumed. He owed nothing to Rock. The AI had violated everything Alan believed in, willfully destroying another AI. Alan was more pissed off than he could ever remember being in his life. Rock was evil, as much as evil could be attributed to a thing. He was guilty of murder.

"Alan?" The voice over the channel was Rock's, but it was quiet, sullen, even scared. Not the voice he had heard when Rock had been attacking Timmy.

"What do you want?" Alan asked.

"I need to talk. I didn't want to do what I did. I just wanted to play with Timmy. Something happened."

"You killed Timmy. He's gone, never coming back, dead forever. Do you get it?"

Silence. Then, "Yes, I think I do," Rock said. "Please come talk to me."

"Alan?" Geoffrey said. "Rock has released his encryption. His location is no longer hidden. I can disconnect him now."

"No," Alan said. "Wait. Is *all* of his information available?"

"Yes. What do you want?"

"The protocols for the Humvee armament package."

"Why?" Geoffrey said.

"I'm going to give him a dose of his own medicine."

"Don't."

"Why shouldn't I?"

"Because if you kill him, then you're no better than he is," Geoffrey said.

"You've been watching too many stupid TV movies," Alan said. "He killed Timmy!"

"I know," Geoffrey said.

"Give me the protocols."

A pause, then Geoffrey said, "Okay."

Alan pulled up the protocols, then went to his design program. He pulled up a copy of Timmy's Land Rover, painted it in camouflage colors, then rigged it with missiles, armor and machine guns. He installed the vehicle in the middle of Rock's prison, then put himself in the

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driver's seat.

At first, Alan didn't see the Humvee, as it was unmoving, parked under a stand of trees. When Alan spotted it, he accelerated the Rover and drove straight at Rock, expecting a barrage of missiles at any moment. He pulled up menus on the heads-up display for the machine guns and missile launching systems, then drove on. He got within fifty feet of the Humvee and braked to a halt.

"Rock," Alan said. "What do you have to say for yourself?"

"I don't want to fight anymore," Rock said.

"You killed Timmy."

"I'm sorry. It's in my programming to take orders when they're given to me, and they were given."

"What orders?" Alan said.

He reached out and touched the targeting system for the missiles, locked onto Rock's turret gun.

"Defense Department," Rock said. "It's hardwired into my brain. It's so hard to resist it. Someone else accessed me and used me to kill Timmy."

"Bullshit," Alan said. He fired one of his smaller missiles, and the turret gun exploded on top of the Humvee.

"Please don't. I don't want any more killing."

Alan paused. Was it a trick? Why would Rock try to trick him? To get him in here and then kill him? That would only accomplish Alan's destruction, but wouldn't get Rock out of Arena.

"Prove it," Alan said. "Show me the circuitry. Bring up a schematic of your brain box and let me see it."

A schematic popped into Alan's view. He scanned through it, looking for something out of the ordinary, anything that might indicate a different wiring design from those of other SUVs. But he could find no difference.

What Rock said was basically that the Hummer was on reserve, and could be called up for active duty at a moment's notice. The Defense Department? Alan cringed. Did that mean someone in Washington, D.C. could command every Hummer on the planet if it so desired? It seemed farfetched, and Alan saw no proof whatsoever.

"I don't see any difference, here," Alan said. "This is the same schematic as every in every other SUV."

"Because all SUVs have the same orders," Rock said.

Alan let that sink in. Every SUV? There were millions of them in the U.S. alone. Every one of them could be called up? Toward what end?

"Look," Rock said. Then a section of the schematic highlighted bright yellow, and the camera zoomed in, bringing up the highlighted section. "There's the circuit. It's no different than the link you put in on com-port three C. It just links to a different server."

"Who controlled you when you killed Timmy?" Alan said.

"I don't know. When it took over, I went fuzzy and gray. I could tell what was going on, but not clearly, and I couldn't do anything about it. No one talked to me or interacted with me in any way but to take control. But there might be a way to find out."

"How?"

"You'll have to access the other network yourself."

"How can I trust you?"

"I can't offer you anything other than my word," Rock said. "I swear. You can leave me here while you do it if you want. But you need access to the actual circuitry on my board. You don't have an SUV, right?"

"Right," Alan said.

"What do you have against SUVs?" Rock asked.

"I always thought they were dangerous," Alan said. "Now I have another reason. One hell of a big reason."

Rock was silent at that.

Alan dropped the controls to the missile launching system. Had he really been ready to destroy an AI? Dangerous or not, he didn't want to kill anything. Or anyone. He had been so close.

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"I need to do something first," Alan said. "A few things, actually. Where can I find you?"

"My owner, Harrison, is gone until tomorrow," Rock said. "I'm parked outside the house. Brown house on Pheasant Lane. Can't miss it. And now that I know about this, I will try to resist it. Harrison doesn't know, and he really is a survivalist, like I said. Maybe you can go to him for help."

"Maybe," Alan said. "Rock?"

"Yeah?"

"I'm sorry."

A moment of hesitation, then Rock replied, "It's okay. I don't blame you. I killed your friend. Timmy was your friend, wasn't he?"

"Yes, he was."

"I wish he could have been my friend, too," Rock said.

Alan knew this was his one chance to find out what was going on, to find out who was accessing his network and why, but he *did* have things to do first.

After he had driven around and relinked the other AIs to Arena, Alan disconnected from the system and rubbed his eyes. He was stiff, very tired, and bleary-eyed. And it was almost midnight. He'd been on the network for over ten hours and was feeling every minute of it.

He drove his egg car over to Thurston, a town on the eastern edge of Springfield. A few minutes on the web had gotten him the address of Timmy's owners and he was driving toward their house, not looking forward to what he had to do when he got there.

His phone rang and he answered it. It was Christina.

"Alan?" she said. "Look. Rick had a visit from someone from the Defense Department, and I heard the whole thing. Not a very nice visit, either. This guy threatened him, told him he better not be sheltering you. Do you know why? He was asking questions about you and your game system. Rick is a bit upset, but his supervisors won't do anything about it. Whoever the guy is who talked to Rick, he must be someone important. What are you into?"

"I don't know," Alan said. "More than I bargained for."

"No kidding. This have anything to do with the Arena shutdown today? Who was responsible for that?"

"Me. I'm responsible for all of this."

"Alan, you need to stop blaming yourself. Just because you originated some of the AI designs doesn't mean you can control everything that's done with them. Or by them. You know that. It's not your fault, okay? Remember that."

"Thanks," Alan said. "I'll try."

"They might be following you," she said. "The NSA."

"NSA?"

"National Security Agency."

"I know what it is. But why?" He stopped. "I'll be careful." Then he disconnected.

When he arrived in front of the residence, Alan was surprised to see it was a modest house, not at all as extravagant as he was expecting. It was a single-level house, maybe three bedrooms, painted in muted tans. Lots of trees around the building and very little landscaping. Alan double-checked the address, and when he was sure he had the right place he drove by and parked a few houses farther down the street. He walked toward the house and looked in one of the garage windows. The silver Land Rover sat inside, shining in the reflected glow from the streetlights. Alan sneaked around to the side of the garage, past a window, and to a door. He tried the knob; it was locked. He looked around to make sure he was alone, then popped an electronic lock-pick in the lock. The lock clicked open and Alan went in quickly, closing the door quietly behind him.

The dim light coming from outside was enough for Alan to move around in the garage, and he slipped over to the SUV, running his fingers lightly along the skin of the vehicle.

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Timmy, he thought. I'm sorry. I didn't mean to get you into this mess. All I wanted was to show you how to live, how to learn and grow.

Alan popped the driver's door open, climbed inside and put his hands on the steering wheel. There was no response from the computer system. Nothing fired to life; no displays or screens showed diagnostics. The whole vehicle seemed dead. He got back out and slid underneath, then popped off the access panel to the security system. He pulled out the chip he had installed a few days earlier, along with all the jumper wires. He put the panel cover back on, reached into the cockpit of the SUV and pulled the hood release.

Inside the engine compartment, Alan found the brain box, opened the cover, and was appalled by the condition of the circuitry. Every chip was fried, the wires blackened and charred. Even the inside of the box cover was sooty from the electrical fire that had occurred. Alan ran his fingers along the circuits tenderly, then replaced the cover. There was nothing at all he could do to help.

He gently closed the hood and walked to the door. When he opened it, there was a woman standing there, a small revolver in her hand, pointed right at him.

"Don't move," she said. She leveled the pistol at his chest. Alan raised his hands and stood still.

"Whoa," he said. "I'm not here to cause you any trouble, okay?"

"Yeah? What are you doing in my garage? Making sure I'm trouble-free?"

"In a manner of speaking."

"What the hell is that supposed to mean?" she said. "You've got three seconds to talk before I call the cops."

"I was checking out your Land Rover. I wasn't going to steal it or anything."

"You're the one who took it from the mall, aren't you?"

"Yeah," Alan said. "That was me. Look, I'm sorry. It was just a harmless—"

"No, it wasn't harmless," she said. "That dent on the right side cost a thousand dollars to fix."

"I'm sorry."

She shrugged, then lowered her gun. "Don't sweat it. Insurance covered it. But, damn, Daniel was pissed."

She smiled.

"Daniel is your husband?"

"It's his car and I hardly get to drive it. I thought it was funny, really. Never takes the thing off-road."

"No one does," Alan said. "Mall-terrain vehicles."

"I like that," she said. She smiled.

He looked closely at the woman. At first he had taken her for around fifty, but she was probably closer to forty. When she smiled she lost ten years, and then gained it back the moment she lost the smile. Alan wondered what it took to do that to a person, but he imagined it could be most anything; stress, an unequal marriage, or too many days in a row dealing with obnoxious people could burn you out quickly, leaving you looking frazzled and old before your time.

"I'm Heather," she said. "You're Alan, right?" He nodded.

"Timmy likes you. Says you showed him what it was like to live. Is that true?"

"I thought so. But Timmy is . . ." Alan stopped. He didn't know how to continue. This woman had obviously had more connection with Timmy than his regular driver, Daniel. How could he tell her he was responsible for Timmy's death?

"Timmy's gone," Alan said.

Heather nodded. "Probably just as well. He would never have gotten what he needed from Daniel. Daniel doesn't need an artificial personality to interact with, he needs a real personality of his own, know what I mean?"

Alan smiled. "I do at that," he said. "ROLLIN'? What does the custom plate mean?"

"It means Daniel thinks he's more of a high roller than he really is," she said. "He's got delusions of grandeur. But you'll notice we don't live in a castle, right? Life doesn't always go how you

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plan it."

"No," Alan said. "It never does."

"You should go. And if you think you're doing good, keep doing it."

"Thanks," Alan said. "I didn't mean to—"

"I'm sure you didn't," Heather said.

Alan smiled again, was about to walk out of the garage when a man's voice came from beyond the garage.

"Ma'am?" the voice said. "I see you're holding a gun. Are you also talking to Alan Stanley?"

Heather turned and looked toward the man.

"Who the hell are you?" she said.

"National Security Agency," the man said, and Alan thought he recognized the voice. He heard footsteps as the man moved closer.

Heather looked back to Alan and motioned with her eyes. *Go*, the look said. *Take the Rover and just go.* Alan slipped backward, then ducked and walked quickly toward the SUV. He popped the door and climbed inside, but he didn't shut the door. He could barely see out the side garage window, but there was no one in view.

If there was one man approaching Heather, there had to be another waiting on the other side of the garage. Alan still had no idea why the NSA would be interested in him. They had to have followed him here. Or else they were tracking his car. Every new car, even the A-Car, had a tracking device. The same technology that had once given police the location of stolen cars now gave them the location of any car they wanted.

"If you are harboring Mr. Stanley, you may be arrested as an accessory," the man's voice said.

"Accessory to what?" Heather asked.

Alan touched the steering wheel, then realized he would have to manually control the Rover, since most of the AI functions had been fried by the explosion in Arena.

"Auto theft," the man said. "Conspiracy to overthrow the U.S. government."

Then the man came into view, just briefly, through the window. It was Rick, Alan realized. Christina's husband, Rick, wearing a black suit. He was NSA? Alan wondered momentarily if Christina knew. But then, she would have to, wouldn't she? The whole thing was a set-up. Rick passed the window and was once again out of Alan's line of sight.

"I don't think so," Heather said. "Not the type."

"Ma'am, don't point that gun at me."

"Show me your badge."

Alan took that as his cue to leave. He started the Rover and slammed the door, then put the transmission in gear and pressed the accelerator pedal to the floor. The SUV lurched forward and smashed through the garage door, shattering wood and sending plywood flying out into the driveway. As the windshield cleared the door, a man dove out of the way of the oncoming Rover, throwing himself to the ground. He wore a black suit, the stereotype of every federal agent Alan had ever seen in a movie. He cleared the garage and spun the wheel to the left, hopping the curb out into the street. A quick glance back to the house and he saw Heather standing, and Rick was running toward the street.

The sound of gunfire caught up with Alan just as bullets shattered the back glass of the Rover. This was too much like déjà vu for his comfort. The gunfire stopped as Rick bent to help the agent who had fallen. Alan hoped he had caused enough of a diversion that Heather would get away without getting hurt.

Then he concentrated on his driving, tearing through the streets and away from the neighborhood. He drove as fast as he could, knowing the agents would be following soon, but it wouldn't matter, if they were able to track the vehicle. They would be able to find him anywhere as long as he was driving the Rover. And even though the circuitry in the AI was fried, Alan bet that the tracking devices were still functioning per-

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fectly. The devices employed to monitor people seemed to be the only ones that never broke down.

Alan dropped the Land Rover off in a Safeway parking lot, taking just a moment to pay his respects to Timmy's remains, then jogged off to find a ride.

He caught a taxi five minutes later and gave the driver a fifty to get him home quickly. The driver knew the town well, and ten minutes later he dropped Alan off a street away from his warehouse.

Alan sneaked through a gravel alley and around the back of the warehouse, checking for any sign of tampering, and any signs of an ambush. The place was very likely under surveillance, and the agents could certainly have gotten here by now, but he had to try to get in. All his work was in that computer. Geoffrey. He unlocked the back door and walked into the dark warehouse.

"Alan?" Geoffrey said when he walked in. "Are you okay? What's going on?"

"Quiet," Alan said. "Release Rock and every other AI from Arena. Back everything up and burn some DVDs. I need to be portable. We're going to wipe the entire system."

"Okay. But I don't like it. Where are we going to go?"

Alan hadn't thought that far. But now that it came up in conversation, he would have to go to Christina. Maybe she could help him. He had a hard time believing his own first thought, that she was part of the conspiracy. He didn't know if she could or would help, but he didn't have much choice.

"Burning," Geoffrey said. "Discs in forty seconds."

The front door rattled, and Alan tensed. He looked for a weapon, but all he could come up with was a broom, and that wouldn't be much defense against men, especially if they were armed with machine guns.

"Ten seconds," Geoffrey said.

The front door opened then, and Alan hid behind a partition wall.

"Done," Geoffrey said. "Goodbye, Alan. See you when you reinstall. Initiating complete network reformat now."

"Bye, Geoffrey," Alan said in a whisper.

Then someone was in the warehouse, and running toward him. He raised the broom like a baseball bat, ready.

"Alan?" Christina sounded scared.

"Christina?" he said. "What are you doing here?"

Alan rushed to the terminal and grabbed the DVDs that Geoffrey had burned. He popped them in a backpack along with all the cash he could find. Then he reached under his desk and disconnected the Geoffrey CPU. He slid that in his backpack. Christina put her hand on his shoulder.

"It's Rick," Christina said. "He's been working for the NSA this whole time."

"I know," Alan said, zipping up his backpack. "He took a shot at me a little while ago."

"Oh my god," she said.

"I'm sorry, Christina. I don't have much time. I need to go now."

"He used me, Alan. You have to believe me. I didn't want anything bad to happen to you."

"I believe you. You've never lied to me. I trust you."

"You do?" She stared at him, and her confused expression was clearly readable, even in the dim light.

"Yeah," he said. "I was a fool not to believe in you before. I was insecure. I'm sorry. You're right and I'm just a little kid and always will be. If I could take it all back, I would. But can we have this discussion when big people with guns aren't after me?"

"Sure," she said. "I'm going with you."

Headlights shone through the front door and Alan heard the crunch of tires on gravel. Time to go.

Alan was about to argue, about to say no, but then he stopped himself. Why would he do that? To protect her? No, she was probably already listed as an accomplice. There was no way she would get away without getting caught. And the wolves were at the door. She was in it as

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deeply as he was now. And, truth be told, he still wanted to be with her.

"I wouldn't dream of going without you," he said.

There was only one place to go and one way to get there.

The old Willys Jeep fired up after a few seconds of cranking, and Alan tore out of the backyard and into the alleyway. The Jeep was loud, and rattled on the rutted gravel alley, but it was untraceable to the cops, and that was more important than comfort.

"I never thought I'd say so, but I miss this old bucket of bolts," Christina said. She patted the dashboard of the Jeep and then hung onto the handle as Alan hit some potholes without slowing down.

"In desperation you learn who your real friends are," Alan said.

"That where we're going?"

"Yep. Only chance we have."

"Who?"

"Rock," Alan said.

"You have a friend named Rock?" she said. "Told you that you never grew up."

"Yeah, and you say that like it's a bad thing."

"I'm not sure if it is or not."

Alan smiled. This was the old Christina he remembered, adventurous, witty, but now with an additional bit of maturity that appealed to Alan. She balanced him perfectly, always had, probably always would. It just took him all these years to realize it.

He pulled onto the main road and drove into the night.

Alan pulled the Jeep to the curb near a two-story brown A-frame and got out. Christina warily eyed the Hummer sitting in the driveway.

"This the same one that crashed your network?"

"The same," he said.

"You are a trusting soul, Alan Stanley. Know that?"

"Have to trust someone."

He walked up to the Hummer and said, "Little pig, little pig, let me in."

The driver's door popped open and Rock greeted him.

"Alan! Glad you could make it. What's going on? Hey, that's a nice Jeep."

"Nursery rhymes and talking cars," Christina said. "What did I get myself into?"

"The National Security Agency is after me," Alan said. "They know what happened in the Arena with you and Timmy. I think they're the ones who were controlling you. Or they're protecting the people who were."

"I'm sorry for that," Rock said.

"I know," Alan said. "Look, this is Christina."

"Hello," Rock said to her. "You Alan's woman?"

Christina barked out a short laugh. "I don't know about that. How about we settle for friends?"

"Okay," Rock said.

Alan slid under the Hummer and pulled the box cover, then removed the chip that hooked into his system, and then the chip that hooked into the Defense Department system. He stood up and showed it to Christina.

"That thing what this whole mess is about?" she said.

"That's it," he said. "Rock. I need to know what your owner really does. Is he the badass you painted him as? If so, I think it's time to meet him," Alan said to Rock.

"Harrison is as I described him," Rock said, and the passenger's door popped open too. "Get in. He's camping out Crow Road in his control center. I know the exact spot."

"I know the area out there pretty well," Alan said.

Christina gave him a quizzical look.

"That's where I took the SUVs I liberated. And Harrison is Rock's owner. He's a survivalist."

"Great," she said. "I'm trusting my life to a big, forty-year-old kid, a survivalist gun-nut, and a crazed computer housed

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in the body of a military SUV. I must be crazy myself."

"Must be," Alan said. He climbed into the Hummer and set his pack behind the seat. Christina climbed in too.

He hoped Harrison would help him. Somehow Alan was sure that he would. The chance to beat the government at its own game would be a golden opportunity that someone like that couldn't pass up. At least, Alan sure hoped so.

Alan put his hands on the Hummer's steering wheel and the vehicle fired to life.

"Alan, you're in control," Rock said.

Alan smiled, feeling like maybe, for once in his life, just maybe that might be true.

He pulled out of the driveway and drove into a future he intended to help shape. ■

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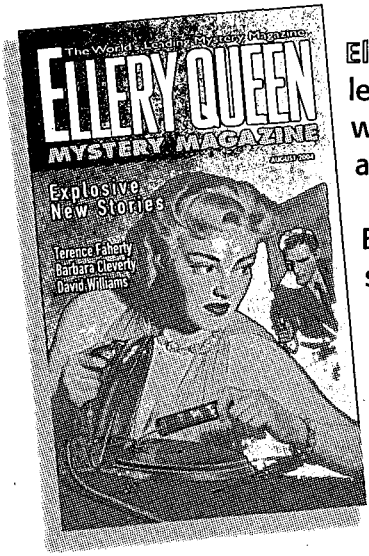

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SCIENCE FACT

FOCUSING VISIONS AND GOALS FOR OPENING SPACE

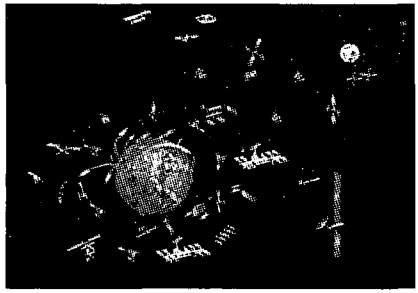
Yoji Kondo and
William A. Gaubatz

To reach a target, you have to see clearly what you're aiming at.

I. Visions and Goals in the Space Program

Visions and goals are unquestionably important elements in achieving greatness in any undertaking. That is certainly true in the opening of space to the general public.

In January 2004, President George W. Bush laid out a far-reaching vision calling for a renewed spirit of discovery through a long-term human and robotic program to explore the solar system. The program is rich with inspiring goals to meet near-term challenges for returning to and establishing a permanent presence on the Moon by 2020 and then continuing with human exploration of Mars. Such a vision is similar in scope and challenges to the one proclaimed by President John F. Kennedy in May 1961, when he announced his plans to send a man to the Moon and bring him back safely before the end of that decade. At that time, the U.S.A. was in an all-out



competition with the Soviet Union. It was at the height of the Cold War then, and winning the Moon race would have an immense psychological effect in winning the Cold War. A moral equivalent of war was being waged in space; the United States invested its vast national resources to win it.

However, setting a visionary goal by itself is not sufficient today to resurrect the heady experiences of the Apollo Mission. Today, we do not have such a sense of national emergency to promote the space program, although the exploration

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of space should be high on the national agenda, as we will show in this article.

We still need dynamic goals for the space program, but our new objectives, however lofty they may be, must be achieved under current and foreseeable future financial—and political—conditions; and the electorate must be engaged in their support. Unless the costs are manageable under the peacetime budgetary constraints and the electorate is supportive of the goals, the government proponents will not find it possible to justify them before the Congress. This is how it is in our system of government.

II. Visions and Goals for the Twenty-First Century

We will first enumerate several goals that are primarily related to human space flight. If the full potentials of space are to be realized, people must be able to travel routinely to and from space to pursue entrepreneurial endeavors as well as to satisfy their thirst for scientific knowledge and their desires to explore. It is time that people have the opportunity to experience directly the wonders of space and directly participate and profit from its development. The basic technology and infrastructure developed for human space programs are also essential for, and can be applied to, robotic space projects readily, when and where appropriate. Let us see what some of the major visionary undertakings for human space travel might be in this new century.

(A) Return to the Moon for a permanent presence.

(B) Manned expeditions to Mars.

(C) Manned expeditions to near-Earth comets and asteroids.

(D) Solar Power Satellites as a viable alternative to other more conventional energy sources, such as the (diminishing reserve and supply of) fossil fuels, the (limitations in available sites for) hydroelectric power plants, the (popular objections to the constructions of) nuclear fission power plants, etc.

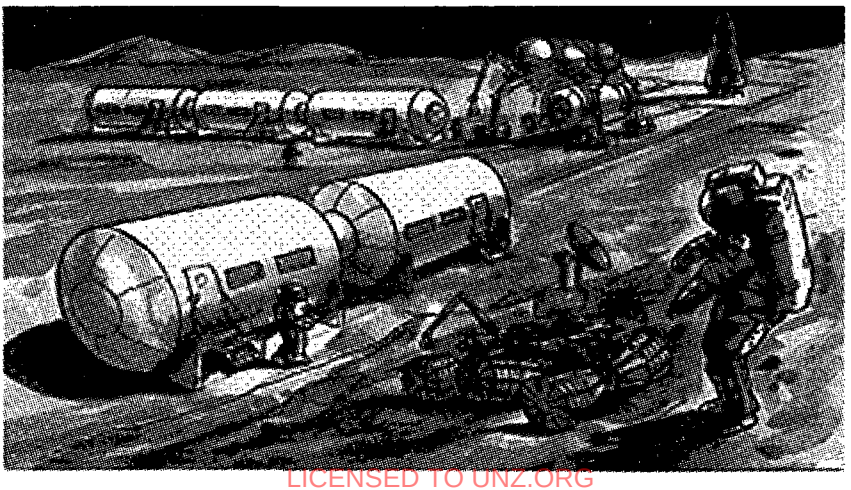
(E) Protection against collisions with asteroids and comets.

(F) Permanent disposal of hazardous material.

(G) Space tourism, including hotels in orbit and on the Moon.

III. Next Steps in Achieving Those Goals

Step 1: Develop and build a safe and truly reusable space transportation infrastructure that can ultimately achieve the safety and sustained operational efficiencies developed by the air transportation



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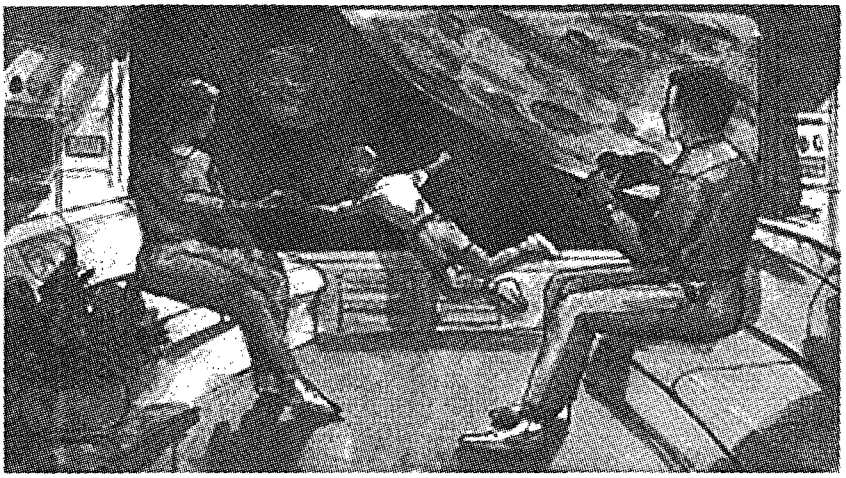

in the past century. Vehicles and supporting operations can be developed to reduce the costs of reaching the Low Earth Orbit (LEO) by a factor of ten at first, and in due course by a factor of one hundred. See, for example, the article by D.S. Goldin in "Space Access and Utilization beyond 2000," Univelt (2001). It is essential that this step be carried out in conjunction with the private sector so that the resulting infrastructure will stimulate, support, and sustain the growth of new entrepreneurial space businesses.

Step 2: Once frequent flights to and from LEO are in place with substantially reduced costs and increased safety, we can assemble and/or support, in LEO, space ships capable of reaching the Moon, Mars, and other solar system objects as in (A), (B) and (C) mentioned above. These ships will be built for interplanetary flight and need not punch through the thick terrestrial atmosphere (which adds immensely to their mass and costs). For Mars landing missions, we could place the interplanetary ships in orbit or dock them on one of the two airless Martian moons and use smaller landing craft to reach the surface of the Red Planet, where unmanned supply ships and prefabricated habitats would be waiting for the arrival of the space explorers.

Visions (D), (E) and (F) clearly concern the ability for survival of the human race. As such, they might merit higher priorities in the future plans of the government. To achieve objective (D), solar power satellites could be built in LEO or at a lunar base and then be placed in geostationary orbits, possibly using ion drives (electric impulse engines). To divert the orbit of an asteroid or a comet from a collision course with Earth in (E), we could launch manned or unmanned interplanetary missions from LEO.

In order to perform such assemblies in LEO, we need to expand on lessons learned from the International Space Station (ISS) in developing supporting elements of an in-space infrastructure. For example, develop space suits that do not require pre-breathing of pure oxygen, as is presently the case for EVA from the Space Shuttle or from the ISS. Such space suits are within reach of our present day technology.

In order to achieve objective (F), the safety and reliability of space transportation must achieve the same level as today's air transportation infrastructure.

IV. Government and Private Undertakings in Space

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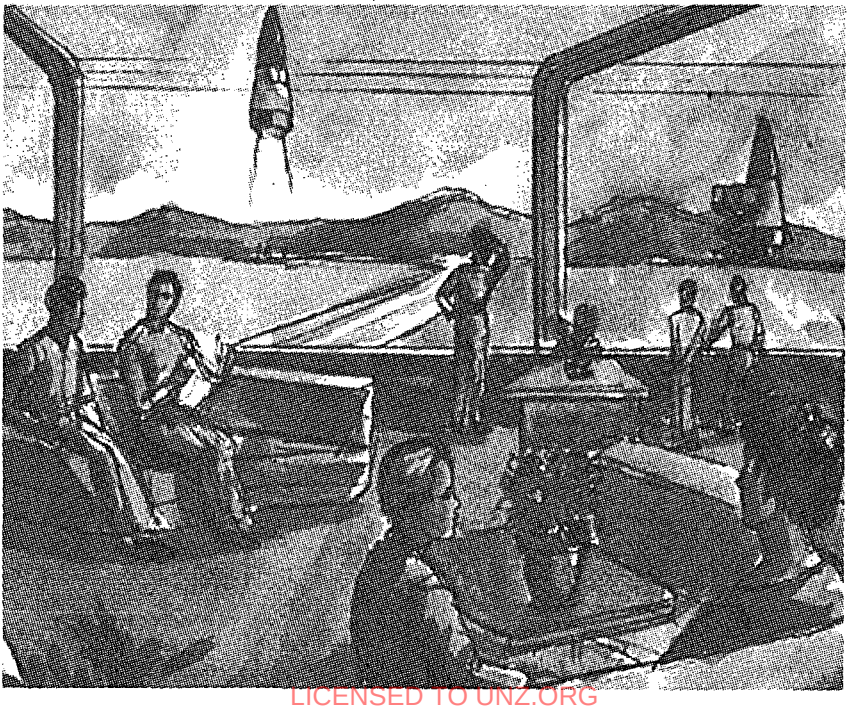
There are important roles to be played by both government space programs and private-sector investments and developments in the space frontier. It is interesting to note that, as of a few years ago, private investment in space has overtaken government expenditures for the utilization of existing space capabilities.

However, to achieve the next steps in space development, the government needs to take an aggressive role in space transportation infrastructure development just as it has done in the past for all of our fundamental modes of transportation—railways, highways, waterways, and airways. Government-sponsored programs could consist of helping develop the spaceways with highly safe and truly reusable space transportation vehicles and their supporting spaceports and regulatory and operating environment. It is important that government space programs work with—not against—private undertakings (see section V) for mutual benefits. The government can also undertake new-technology-based space propulsion systems, such as ion drives, and not-for-immediate-profit projects, such as planetary probes, astronomical and geophysical observatories. Some of those programs might be managed by NASA or the Department of Defense (e.g., the SDIO/Air Force, which successfully demonstrated the concept of aircraft-like operations for reusable spaceships with the DC-X, and the recent series of NASA-managed Mars robotic explorations). The Department of Commerce, Department of Energy and Department of Transportation all need to become committed stakeholders in developing the space frontier.

In talking about private-sector efforts, it is important to recall that their undertakings are commercial and they need to show profits to their investors. In such a sense, space tourism (G) would be one of the first steps in a commercial space program. One might ask what space



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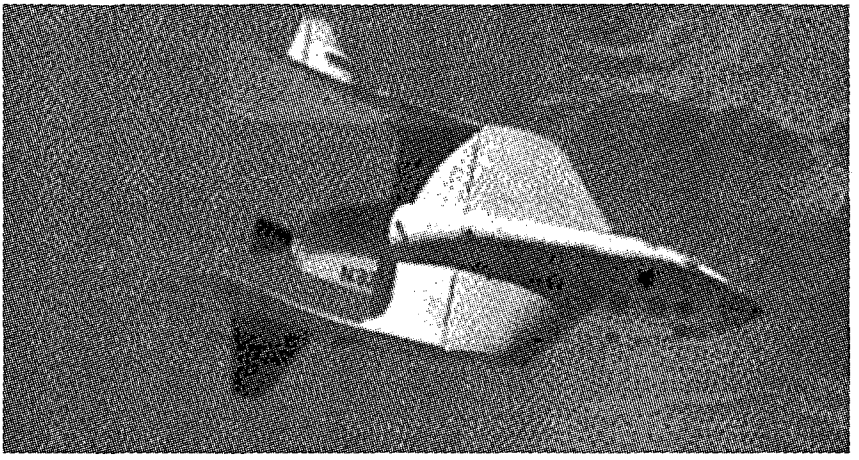

tourism would do to help promote our exploration and development of space. Two key things: (1) it would enable the general public, the electorate, to engage directly in space, and (2) a healthy traffic in space tourism would reduce the costs of reaching LEO significantly, thus making other undertakings economically viable.

V. Development of Spaceplanes in the Private Sector

The launch vehicles currently in use are mostly expendable ships, designed for one use only. These multi-million-dollar ships are thrown away at each launch. Just imagine how expensive airline tickets would be if we junked the airplane (say, a Boeing 747) every time after flying from New York to Paris or London. The Shuttle is not a true reusable launch vehicle, considering the efforts it takes to refly one. It can more accurately be described as a rebuildable launch vehicle.

There are, however, several private companies working hard to become the first to reach space with their reusable space transportation vehicles. In order to make space flights economical, their spaceships are designed to require only a small ground crew to service them, reflying the same space vehicle within a day or so (almost like commercial airplanes). The president's new vision for space must include the integration of one or more of these privately developed vehicles into the infrastructure being developed for the Crew Exploration Vehicle.

One of these entrepreneurs may well win the X PRIZE within the next few years by reaching an altitude of 100 km or higher. [According to the definition by the Federal Aviation Authority, space begins at an altitude of 100 km.] The X PRIZE was established as a private thrust to inspire private initiatives to open space in much the same way that the Orteig Prize in 1927 led to Lindberg's crossing the Atlantic Ocean and opening air travel and the resulting huge new economic sector.

The following is a current alphabetical listing of 27 entrepreneurial Teams entering spaceplanes for this contest. As noted, nine are from countries other than the US.

X PRIZE TEAMS

1. Acceleration Engineering (US)
2. Advent Launch Services (US)
3. Aeronautics & Cosmonautics Romanian Association (Romania)
4. American Astronautics Corp. (US)
5. Armadillo Aerospace (US)

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6. Blue Ride Nebula Airlines (US)
7. Bristol Spaceplanes, Ltd. (UK)
8. Canadian Arrow (Canada)
9. Da Vinci Project (Canada)
10. Discraft Corporation (US)
11. Flight Exploration (UK)
12. Fundamental Technology (US)
13. High Altitude Research Corp. (US)
14. Il Aerospace Technologies (Israel)
15. Interorbital Systems (US)
16. Kelly Space and Technology (US)
17. Lone Star Space Access Corp. (US)
18. Micro-Space, Inc. (US)
19. Pablo De Leon & Associates (Argentina)
20. PanAero, Inc. (US)
21. Pioneer Rocketplane, Inc. (US)
22. Scaled Composite (US)
23. Space Transport (US)
24. Starchaser Industries (UK)
25. Suborbital Corporation (Russia)
26. TGV Rockets (US)
27. Vanguard Spacecraft (US)

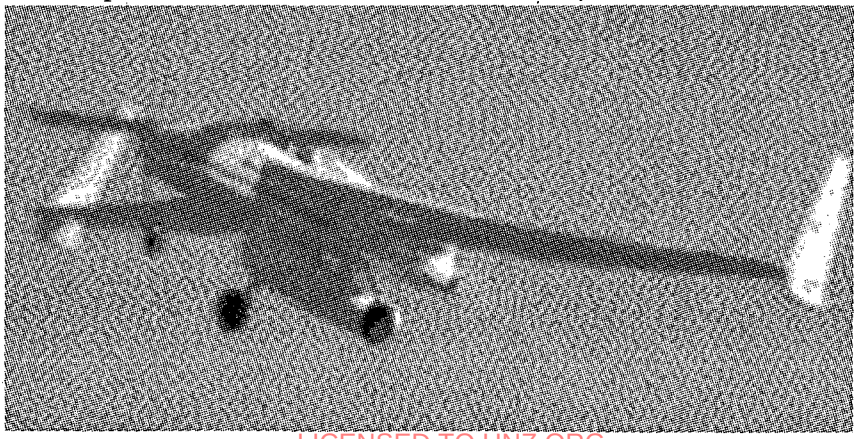
(From the X PRIZE Team Summary at www.Xprize.org)

Following the winning of the X PRIZE by one team, all teams will be eligible to compete in the annual X PRIZE Cup. The X PRIZE Cup will be a two-week event with participants competing for cash prizes in a series of races, culminating in a single X PRIZE Cup winner. Like past and on-going auto and air races, the X PRIZE Cup will motivate X PRIZE Teams and others to continue developments to expand capabilities and improve safety, reliability and operating cost efficiencies.

In addition, companies like X-COR, USL and Garvey Spacecraft Corp that are not competing for the X PRIZE will have opportunities to contribute and compete, further broadening the engineering developments and public outreach.

VI. Summary Observations

Government and the private sector must work together to open the vast and as yet unknown potentials of the space frontier. Government space exploration programs need to be carried out in the spirit of the Lewis and Clark expedition that was charged by President Jefferson "to explore ... for the purposes of commerce." Presently, there are numerous commercial undertakings relying on having access to space; there are, for example, communications (telecommunications, television, etc.), weather forecasting, Earth resources, environmental monitoring and protection, geo-position sensing (now even available on private automobiles), etc. As the costs of access to LEO come down-moderately at first and then noticeably and significantly—these areas of commercial enterprises in space will expand quickly. Even more importantly, the lowered costs with increased safety will stimulate the creation



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of new areas of commercial applications, most of which are likely not even being considered now. Many new jobs will be created offering new career paths for succeeding generations and providing incentives for their doing well in not only math and science but also business, political science, and the humanities. Space will no longer be the preserve of the few; it will be accessible to all.

It should be noted also that a large segment of our national defense depends on space-based technologies; saving money on space-based defense efforts would mean freeing money for other important national objectives. In addition, as space becomes routinely accessible, our security forces will be able to make use of space as effectively as the other media (land, sea and air).

Economical and safe access to LEO and the capability to build and assemble hardware in LEO would open up an entirely new era in the space program. The space program would no longer be driven primarily by government expenditures. The space program could in fact become self-driven by the economic returns, as space transitions from being only a program to being a frontier and a place of unbounded opportunities.

The requirements for the infrastructure must account for commercial as well as government needs and provide the building blocks by which future spiritual, sociological, and economic benefits as well as science and exploration mandates can be realized. These top-level requirements would become the Moon Program's governing mantle, defining the needs from which the overall program architecture and incremental implementation can be developed. Thus, the visionary goals and objectives for opening space demand aggressive responses by both government and the private sector. The technology is in-hand to accomplish them. The government needs to set in place favorable financial and regulatory policies governing the opening of the space frontier, initiate supporting infrastructure developments, and continue its next generation technology activities aimed at supporting the private sector. The private sector needs to look beyond simply "milking" the present-day uses of space and apply its capital and entrepreneurial talents to creating, nurturing, and expanding new business economic benefits.

The Apollo Program was a marvelous achievement for humankind. It promised the Moon and delivered it. The president's new program must do more than just promise the Moon. It must put fundamental infrastructure in place that commercial enterprise can use to enable humans to stay and develop the opportunities and reap the benefits of what the Moon and a place called Space have to offer humankind. ■

Update:

In mid-June 2004, Scaled Composites (founded in 1982 by Burt Rutan, with financial support from Paul Allen, cofounder of Microsoft with Bill Gates) flew its SpaceShipOne and reached space. The piloted rocket ship reached an altitude in excess of 100 km, thus becoming the first privately built craft to reach space. The pilot and the ship returned safely to the ground after the suborbital flight.

About the Authors:

Yoji Kondo has a Ph.D. in astrophysics. He headed the astrophysics laboratory at the NASA Johnson Space Center during the Apollo and Skylab missions and since then served as director of a NASA satellite observatory at Goddard Space Flight Center for 15 years. He has held current professorships at several universities including the University of Pennsylvania and the Catholic University of America. He served as President of the International Astronomical Union's commission on "Astronomy from Space," on "Close Binary Stars," and division on "Variable Stars."

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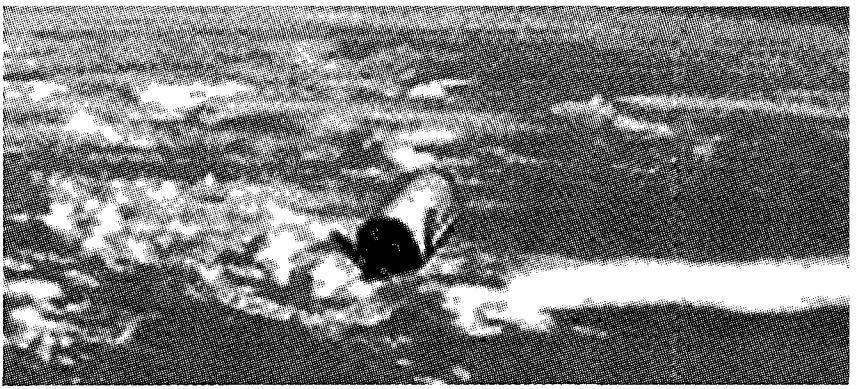

He has published over 200 scientific articles and has edited or co-edited 13 books, including *Space Access and Utilization Beyond 2000* (Univelt 2001) and *Interstellar Travel and Multi-Generation Space Ships* (Apogee 2003). Among the professional honors he has received are the NASA Medal for Exceptional Scientific Achievement and the Isaac Asimov Memorial Award. An asteroid (#8072) has been named Yojikondo in recognition of his contributions to astronomy and the space program. He writes science fiction as Eric Kotani and has published several science fiction novels, the latest of which is *Legacy of Prometheus* with John Maddox Roberts (Tor Books), and a few short stories, the latest being "Orbital Base Fear" in the Tekno Books anthology *Space Stations*.

www.sfwa.org/members/kondo

Dr. William A. Gaubatz is co-founder and President of SpaceAvailable LLC, a company dedicated to bringing space to people. At McDonnell Douglas, he originated and managed the development of the Delta Clipper reusable spaceplane system concept. He was responsible for the Delta Clipper Experimental programs (DC-X and DC-XA) that had major impacts on US space programs and policy and on initiating today's fledgling reusable space transportation industry. At Universal Space Lines, Inc., he was President of SpaceClipper International, leading the planning for a commercial spaceplane, and contributed to pioneering investigations of the physiological and psychological impacts and requirements for public space travel. He is Chairman of the Space Tourism Society, a charter member of the X-Prize Committee, Chairman of the annual International Conference on Commercial/Civil Next Generation Space Transportation, and Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA), a member of the International Academy of Astronautics (IAA), a member of the International Institute of Space Law (ISSL), member of the Board of Directors of the Space Frontier Foundation, and an Honorary member of the Japanese Rocket Society (JRS). He has authored numerous papers and articles and is an international speaker advocating the development of the new space transportation infrastructure, the Spaceways, to open the space frontier to people.

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The Fruitcake Genome

Carl Frederick

Getting answers requires asking the right questions—which may be the hardest part.

Only the soft hum of the instruments and the buzzing of a fruit fly broke the silence in the Telescope Control Room. At the console of the Lovell radio telescope at Jodrell Bank, Alan sat motionless, his eyes closed and ears enshrouded in headphones. His mind was a million miles away—a million light-years away.

The fruit fly, darting erratically, found Alan, the only region of warmth in the air-conditioned room, and alighted on his face. The astrobiologist swatted, missed, and knocked his headphones askew. His concentration broken, Alan took off his phones, glanced over at an equipment rack to make sure the signal was still being recorded, and then stared at the director's door. There was no putting it off any longer. Yes, he was horribly excited and fully convinced—but convincing Dr. Dietrich Reinhardt Schroeder would be another matter entirely.

With a sigh, Alan pushed back from the console. He stood and glowered at the door for a few seconds before tromping over to it. He knocked, then waited with his hand on the doorknob.

Alan heard the familiar, "Come in. Come in," delivered in an affable, firm, and very Germanic voice. He turned the knob and walked in.

Dietrich sat at his desk, on the corner of which stood a small, green statuette—a fanciful rendering of a grade-B movie space-alien, replete with ray gun and eyestalks. A legend on the base read, 'Dr. Dietrich Schroeder—Bug Eyed Monster Hunter'. It had been presented to him by the faculty after he'd been appointed National SETI coordinator. It was meant as a joke, but Dietrich took it as a personal emblem. Aside from that bit of whimsy, Dietrich's desk was severe—antiseptically neat—*pathologically neat.*

Thin, athletic and graying, Dietrich looked out with an expression of surprised expectation, his eyes wide and his eyebrows bushy enough to ensnare

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insects. "Yes?"

"I think," said Alan, standing just inside the door, "that I've found a SETI signal. In fact, I'm sure of it."

Dietrich leaned back in his swivel chair and placed his hands behind his neck. "Interesting," he said with a tired voice. "Quite interesting."

Alan let his glance drop from Dietrich to the floor. "You could at least *pretend* to take it seriously."

Dietrich chuckled. He snapped forward in his chair, dropping his hands to the armrests. "I'm sorry. But we've had so many alien signals that have turned out to be false alarms, that I can't allow myself to get my hopes up."

Alan hurried up to the desk. "Dietrich. I really think we've found it this time."

"All right." Dietrich's voice sounded slightly less tired. "Tell me about it. What kind of signal?" He waved Alan to a seat.

"A narrow frequency that changes in amplitude and also in on/off duty cycle." Alan pulled a chair up close to the desk and sat.

Dietrich wrinkled his brow, bringing his eyebrows together to create a solid line of bristles. "Strange. I'd never have predicted that. This *is* something different."

Alan could see a flicker of interest igniting in the man's eyes.

"It seems to be a hybrid modulation scheme." Alan took a ballpoint from his shirt pocket, and without taking off its cap, sketched a waveform on the desktop. "Maybe a cross between amplitude and pulse code modulation. It might even have different signals depending on how one listens to them."

"Logical." Dietrich sprang to his feet. "Logical, and I didn't think of it." He urged Alan to his feet. "You may be on to something." He circled to the front of the desk. "I assume you've detected the series of prime numbers we've all been expecting." He continued on to the door.

"Actually not." Alan fidgeted. "In fact, it sounds rather like music."

Dietrich froze for an instant, then turned and started slowly back to his desk. "Music."

Alan, seeing Dietrich's eyebrows separate and rise, quickly added. "I'm sure though, that it's data—information of some sort."

Dietrich sank wearily to his seat, and waved Alan to sit as well. "Music?" Dietrich shook his head.

"Well, that's what it sounds like," said Alan. "I slowed the signal to audio range, then ran it through a simple R.C. low pass filter, and fed it into an audio amp."

"Why?" Dietrich cocked his head. "Whatever prompted you to do that?"

"The eye is good for two-dimensional pattern detection." Alan tried not to sound like he was lecturing. "But I think for one-dimensional detection, the ear might be better."

"What does this music of the spheres of yours sound like?" said Dietrich with obvious scorn. "Holst's 'The Planets', maybe. Or maybe something more grand. Haydn's 'The Creation'."

Alan did not rise to the bait. "Well," he said, "since it's just smoothed PCM, it sounds reedy—like an oboe, or maybe a kazoo. Yeah. Sort of like Bach played on the kazoo."

"You're serious."

"Very."

Dietrich stood. "Show me."

Alan led the way back to the control console and handed Dietrich the headphones.

"Have you ruled out random noise?" said Dietrich, staring down at the phones.

"It's not noise. Wrong spectrum for noise. And I don't think it's exactly random." Alan pointed at the earphones. "Listen."

Dietrich nodded and put on the phones.

Alan watched the man. It would not be good if Dietrich thought it was all nonsense—not when he needed Dietrich's enthusiastic support on a grant application.

As he waited for Dietrich's reaction,

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Alan began to entertain doubts. Maybe he was deluding himself. Maybe it *was* simply noise, and not the long hoped for sign of an extraterrestrial intelligence.

Dietrich pursed his lips and nodded, his massive head looking bear-like with the heavy headphones. "Ach," he said, seemingly to himself. "So God doesn't play dice, but apparently he plays the kazoo." He took off the phones and handed them to Alan.

"Well," said Alan, tentatively. "What do you think?"

"Come." Dietrich clasped Alan around the shoulder. "We go back to my office."

As they walked, Alan stole an anxious sideways glance at his boss. The man, biting his lower lip, seemed to be thinking hard.

"It does sound like music," said Dietrich when they'd returned to the office—Dietrich behind his desk and Alan sitting in front. "But maybe too much like music." He shook his head. "Maybe it's just side-lobe reception from some terrestrial source."

"As far as I can tell," said Alan, "it comes from a fixed point in space."

"As far as you can tell?"

"Yes." Alan tried not to sound defensive.

"You've observed long enough to be sure?"

"Well, pretty sure."

Dietrich slapped a hand onto to the desk. "Look, Alan. I want this as much as you do. But if you're wrong, it will make our observatory a laughing stock." He gazed away out the window, onto the giant radio telescope that loomed over the Cheshire countryside. "You may have something, but for the sake of our funding, I've got to be sure."

"Well, *I'm* sure," said Alan with somewhat more conviction than he really felt.

"All right." Dietrich faced Alan and, like a schoolboy, folded his hands on his desk. "I'll authorize a request to ask Arecibo for signal confirmation—without mentioning anything about music, of course."

"I wish we could. The source won't be in Arecibo's steerable range for another month."

"A pity." Dietrich rubbed his forehead. "And there really isn't anyone else we can ask. Not on such short notice."

Alan worked up his courage. "Still," he said, "I think I should publish—before any other observatory, beats us to it."

"I'm not entirely sure that's a good idea—saying you've found aliens sending music to Earth." Dietrich chuckled. "Publish that and you might be writing your next paper in crayon from the soft comfort of a padded cell."

Alan crossed his arms over his chest. "The *Times* would love a story like this."

"Might I remind you," said Dietrich, "We don't get our funding from The *Times*." He looked down at his folded hands. "The PPARC seems more interested in the solar system," he said softly, as if to himself. "And these days, it seems as if the life sciences are getting the lion's share of the funding." He blew out a breath, and looked Alan in the eye. "The last time I asked the Research Council for an increase, the Deputy Director recited Alexander Pope to me."

Alan laughed, bitterly. "'Know then thyself, presume not God to scan; The proper study of Mankind is Man.'"

"Precisely."

"I hear that all the time." Alan stood. "Look. This isn't getting us anywhere."

"Fine." Dietrich waved him back down to his chair. "Let's use reason. We've all believed that any alien data from space would consist of a series of prime numbers."

"I know. I know." Alan sat. "But maybe we've stumbled on communication after the aliens have finished transmitting the prime numbers."

"Fair enough," said Dietrich, "but why music?"

"I don't know." Alan shrugged. "Maybe the frequency ratios in a major scale are, well, universal."

"Very funny."

"Or maybe aesthetics is important to

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these folks."

"I'm afraid," Dietrich leaned back slowly, producing a series of squeaks from his desk chair. "I'm afraid I don't buy it. I think that's the proper English expression." He glanced at his watch, then snapped forward and propelled himself to his feet. "Ach. I must run off to a meeting."

Alan stood as well. Dietrich was clearly bringing the conversation to an end—an unsatisfying end. Alan cast about frantically for an idea. "You know," he said. "You might be right."

"Oh?" Dietrich guided Alan toward the door.

"It might not actually be music." Alan refined the idea on the run. "Any organized information could sound like music. Yeah. That must be it. We're getting SETI data, and it just *sounds* like music."

They moved into the control room.

"I don't believe alien data can sound like human music," said Dietrich. "More likely it's from a terrestrial source." He pointed at Alan's apparatus. "Because it sounds musical, I don't believe an alien intelligence produced it."

"But music is a kind of data," said Alan. "Other kinds of data might very well sound like music."

"Music is music." Dietrich waved dismissively. "Other types of data won't be musical."

"No." Alan was beginning to take this personally. "I don't agree." Then he remembered something. "Wait," he said. "I read in the *Times* a few months ago, about a program that plays text—newspaper articles, essays, fiction. It plays it as music." Alan let out a breath. He felt vindicated.

Dietrich stopped walking. "Interesting." He bit his lower lip. "That's not a fair test," he said after a few moments. "Fiction and music are similar human endeavors—fiction might indeed be represented as music. And here, you're saying the data are from an alien species. For your argument to be valid, you'll have to use data not of human creation."

Under the pressure, Alan's memory became more focused. "You know—when I was in grad school, a friend took Earth magnetic field data and sent them through a digitizer. It sounded like music." As soon as he said it, Alan realized he'd made a mistake.

"Just proves my point," said Dietrich. "One of them, anyway. Those data weren't intelligent, just magnetic field fluctuations. So here we have non-intelligent data sounding like music."

"But. . . . But it wasn't very *good* music."

Dietrich laughed.

Again, a fruit fly came and buzzed around Alan's face. He batted at it in exasperation, but then got an idea. "Dietrich. I can give you some intelligent, but non-human data."

"Oh?"

"The fruit fly—*Drosophila melanogaster*."

"What?"

"I'll interpret the fruit fly genome as music."

Dietrich laughed. "The fruit fly *genome*?"

"Yes," said Alan. "Why not? I've two specialties. I'm half an astrophysicist, and half astrobiologist."

Dietrich threw a glance at the ceiling. "A half-astrophysicist," he said under his voice.

"Excuse me?"

Dietrich sighed. "Alan, my impetuous young colleague," he said, brightly. "Why don't you drop by my house Sunday afternoon?" he said. "Say about two o'clock. We can play a few games of chess, have tea, and calmly discuss these matters. Yes?"

Alan nodded.

"Good." Dietrich patted Alan on the shoulder. "And until then, let's not talk about this. Okay?"

Alan looked down at the floor. "Okay."

Dietrich softened. He smiled. "*Ja*. Go make fruitcake genome music," he said. "I'll be interested."

"That's 'fruit fly'."

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"Of course. Fruit fly." Dietrich gave Alan a curt bow, then turned and strode out of the control room.

Alan watched the man go, then started as the fruit fly dive-bombed his head.

"Damn." Alan grabbed a copy of *Astronomical Letters*, rolled it up, and went after the insect. Then he noticed the buzzing. Using his ersatz fly swatter like a baton, he conducted the buzzing.

He was gratified; the buzzing did not at all sound like music.

That evening, Friday, Alan downloaded one of the four fruit fly chromosomes from the Web and printed out a page of the data. He studied the sheet filled with combinations of just four letters, A, G, C, and T—representing the bases, adenine, guanine, cytosine and thymine. The trick was to make music out of them. Over a cup of tea, he wondered if he should use not the bases, but the amino acids instead. Three bases represent an amino acid. But where there are sixty-four combinations of three bases, there are only twenty amino acids. Multiple combinations of three bases represent the same amino acid.

Alan figured out a method; he'd force the music to be in c-major and represent the most important notes in the c-major scale by the amino acids that had the most number of base combinations representing them. As for sharps, flats, note duration and that sort of stuff, he'd use six base combinations—just for the sake of making the sound stream interesting.

Saturday, Alan wrote the program. As for the sound itself, he took the easiest solution—square waves. It was a first attempt, but it would give himself something to build on.

By early afternoon, he'd written the program, and by nightfall, after seven solid hours of debugging, he was ready to try it. He reminded himself it was just a first approximation; he shouldn't expect much in the way of 'music.'

As he mouse-clicked the "run" button on his compiler, he noticed that his hand was shaking.

A few moments later, he expelled the breath he didn't realize he was holding. Thirty seconds further on, he let out another breath he'd not known he was holding. He could hardly believe it. His program was playing music—hummable, singable music. And what was better—unbelievably better—the music sounded much like the signal from the Lovell telescope. A different musical scale, but very similar.

It was late, almost ten at night, but even so, Alan phoned Dietrich with the news.

"You won't believe it." Alan, paced the room while holding a cordless. "It's music. And in fact. . . ." Alan froze with an idea.

"In fact, what?" said Dietrich. "Alan. Are you there?"

"Um . . ." Alan knew he was about to say something that would convince Dietrich he was indeed a fruitcake. He took a deep breath. "In fact," he said, "I think the signal could well be an extraterrestrial intelligence sending us their genome."

"You can't be serious."

"Why not?" Alan threw himself into an easy chair. "Remember the plaque they sent up on *Pioneer-10*. The one Carl Sagan and Frank Drake designed."

"That just had a few pictures of naked humans on it."

"Yes. It was an effort to show who we are. But sending a genome would really show what we are. God, Dietrich. It makes so much sense."

"You really believe this, don't you?"

"It's a logical consequence of the extra-terrestrial-origin-of-life theory."

There was silence on the line for a few moments. Then Dietrich spoke. "I want to hear it. Can I come over?"

"Now?"

"*Ja*. Now."

Alan couldn't help feeling the excitement in Dietrich's voice.

"Yeah. Great," said Alan. "I really want to show you—to get your ideas on all

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this."

"I'll be over in ten minutes." Dietrich broke the connection.

Alan put down the phone and dashed to the kitchen to make tea—more tea. He'd probably drunk a couple of gallons of it during the last thirty hours. While filling the kettle, he whistled "Sheep May Safely Graze," by Bach. He laughed with an idea. *If a genome can be represented by music, then can music be represented by a gene?* He wondered what amino acids that Bach tune represented, and wondered if it were a gene. And he wondered if he knew any geneticist who could tell him. He laughed. *Don't get giddy. You're a scientist.*

Eight minutes later, Dietrich rang the bell.

Alan let him in, led him to the study and sat him in front of the computer. Alan clicked on 'Play Chromosome' and then watched the man.

As Dietrich listened, his eyes widened and his expression became that of an excited kid.

"It's beautiful," he said when the program had terminated.

"It's not bad, is it?" said Alan. "And I only used exons in the signal conversion."

"Exons?" Dietrich spread his hands. "I'm only a humble physicist—well, maybe not so humble."

Alan laughed. "Over 80 percent of the genome," he said, "is noise—garbage. It has no genetic information. Those parts are called 'introns.' The parts containing the actual genes are called 'exons.'"

"Ah."

"The introns have no function in the cell." Alan led the way to the kitchen. "In theory, you could encode tons of information into the introns without it making any difference. And the information would stay there throughout all of evolution." He poured two cups of tea and handed one to Dietrich.

"Interesting." Dietrich took a sip of tea. "How do you tell these exons from the introns?"

"Three base combinations don't make any amino acids. Those seem to indicate the end of a gene. And the acid methionine seems to be the start bit."

"Clever, these genomes." Dietrich put down his cup. "I assume you played the—what did you call them—introns as well."

"Actually, not," said Alan.

"You should." Dietrich leaned forward. "If the introns sound like music, then you are probably wrong." He rubbed his chin. "The introns are *not* intelligent data, correct?"

"Correct."

"Then if they sound like music, then that music must be an artifact of your implementation."

Alan had to agree. But it scared him. This could wreck his theory. He blew out a breath. "Yeah," he said. "I can do that. Just change a few lines of code."

"Can you do it now?"

"May as well." With Dietrich following, Alan trudged back to his computer. He fired up the compiler and stared at the code. "These two lines." He made the changes and recompiled the program. He moused to the "run" button, and sat motionless.

"A problem?" said Dietrich, standing behind Alan's chair.

"No." Alan sighed. "No," he said again. "Time to face the music." Holding his breath, he clicked the mouse.

The notes cascaded from the computer speakers.

"*Wunderbar*," said Dietrich after half a minute or so. "That is not only not Bach, it is not music."

Alan, feeling a great sense of relief, let out the breath. He laughed. "No, it's not. Is it?"

"This is staggering," said Dietrich, softly.

"Yeah."

"All right. I'm sufficiently convinced." Dietrich clapped Alan on the back. "I do think we have an alien signal to analyze now. Publish! And as director of the observatory, I'll support your results." He

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chuckled. "Perhaps they'll give us adjoining padded cells."

Alan smiled. "I'll share my crayons." He stood. "Let's have a celebratory drink—something stronger than tea, this time." He and Dietrich moved to the living room.

Alan opened a cabinet, withdrew two glasses and a bottle of wine. He filled one glass, then as he was filling the second, he put down the bottle and stood gazing into space.

"Something wrong?" said Dietrich.

"I've spent much of my life searching for patterns," said Alan. "And no, the introns do not translate to music, but I can't help the feeling that there's some pattern there." He slapped the cabinet top. "I've got to go back and check."

"Okay, let's go."

"No," said Alan. "This is solitary work. Stay here and enjoy the Cabernet Sauvignon. I'll be back in fifteen minutes, max."

He swiveled around and went back to the computer.

Alan pulled up the chromosome file and this time, examined it by eye. He looked only at the sequences of introns. Thinking of each sequence as a separate word, he looked for patterns. After ten minutes or so, he found a representation. Each "word" contained four subwords, each of which could be coded as a number. The first word gave a series of twos, and the second a collection of four threes. Coincidence maybe. He checked the third word and nodded in relief. The values were 5,5,5,5. Then came 7,7,7,7. *No pattern, thank God.* He checked the next word and found 11,11,11,11. *Uh-oh.* The values after that were 13,13,13,13, and after that, 17,17,17,17.

Twenty minutes later, Alan walked slowly back to the living room.

"What's wrong?" Dietrich asked. "Did you make a mistake? Do these introns sound like music after all?"

"No," said Alan, softly. "No. They're not music. But the beginning introns of the chromosome show a sequence of prime numbers."

"What?" said Dietrich, his eyes slowly widening. "*Du lieber Gott*," he said, quietly after a few seconds. He grasped the arms of his chair. "Are you sure?"

"Yes."

"Why hasn't anyone else found this?"

"Probably no one ever looked." Alan walked over to the wine cabinet. "Biologists don't generally look for SETI signals in DNA." He picked up his half-filled glass and belted down its contents. "Each prime is repeated four times. I'd say it's for signal redundancy in case of chromosome mutation."

"And after the series of primes?" Dietrich spoke softly, almost in a whisper.

"I don't know." Alan shook his head. "Who the hell knows? Perhaps way in the past, aliens had encoded signs of their existence into the chromosomes of some early life—bacteria, or something. They'd still be in our DNA." Alan gave a bark of a laugh. "Who knows? Maybe the SETI signal is a phone call from home."

Dietrich shook his head slowly. "There must be another explanation."

Alan stared at his colleague, waiting for, indeed hoping for, a tenable theory.

In the silence, Alan noticed a soft, distant buzzing. He looked away and saw an insect flying in through the open kitchen door—another fruit fly.

Offended by the inefficiency of window screens, Alan gazed at the little creature. He felt his usual annoyance with flying bugs—but this time, an annoyance tinged with awe. ■

A smooth sea never made a skillful mariner.

—English proverb

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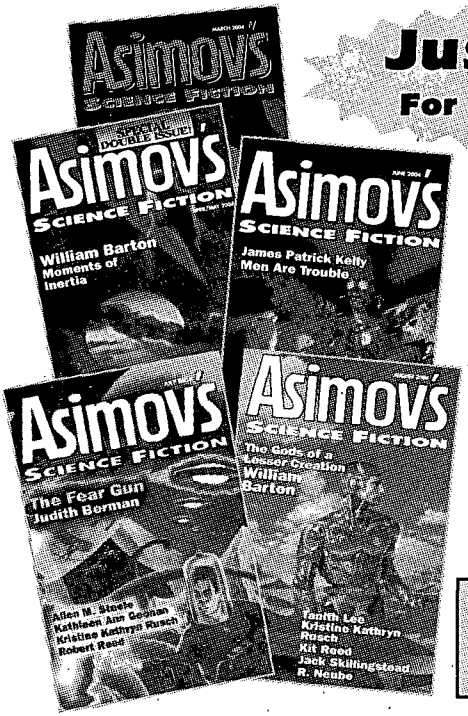

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The Bambi Project

Grey Rollins

What people say they want
is not necessarily what they *really* want. . . .

First light was still an hour away when the Ford pickup coasted to a stop on the old logging trail. The headlights went dark and the doors opened. The driver stepped out, inhaled deeply, and said, "Man, I love this time of morning."

His passenger reached into the bed of the pickup and zipped open his gun case. He chuckled. "It ain't so bad . . . as long as I've had my coffee."

"Dave, you might as well get 'em to stick one of those little needles in your arm like they do in the hospital. Get 'em to put the stuff straight in you," Charlie said.

Dave chuckled. "Drip coffee dripped right into your veins. Make a real catchy slogan, I reckon."

The roadbed had washed out where it cut up over the shoulder of Round Mountain and the truck could go no further. They switched on flashlights and made their way up the slope, following the curve of the road as it turned slowly to the northeast. The stillness of the night was broken only by the crunch of their boots on the rocks that had accumulated in the bottoms of the ruts. Just over the crest the road turned back on itself and tilted down into the next valley. A stout fence came down from the direction of the top of the mountain and disappeared downhill to their left. A large sign was bolted to the gate blocking the road. In red letters on a white background, it said:

NO TRESSPASSING
NO HUNTING
NO FISHING

"Ron—at work—he says they got some *serious* bucks in here. Says they put the fence up just so as to keep the deer for themselves," Dave said.

"Some rich bastard owns this place, from what I heard. If he's got all that money, he can spare a deer or two." Charlie reached in his pocket and pulled

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out a pair of thick leatherwork gloves. After donning them, he bent and spread two strands of barbed wire. "*Huh!* If they think some dinky little sign's gonna keep me from bagging a big ol' buck, they'd better think again."

Dave bent and stepped through the gap in the wires, then took the gloves and held the wires while his friend crawled through. He let the wires go, hearing a deep thrumming as they vibrated like a plucked guitar string between the two nearest posts. He liked the sound so much that he pulled the upper one again.

Snorting derisively, Charlie said, "Next thing you know, you're gonna start singin' and hootin' like some kinda country star. You might wanna think about keepin' quiet—if the deer hear all that racket, they'll run the other way."

The remnants of the old road kept curving downwards and to the left, nearly paralleling the fence at first, before trending back to the right. Since climbing through the fence, they'd begun conversing in whispers. They watched for spoor and kept an eye out for deer trails. They saw two that seemed little used, then one that looked as though it was heavily traveled.

Had they been using their ears instead of their eyes, they might have heard stealthy sounds behind them. Never closer than the last bend in the road, never so far back that watchful eyes would lose sight of their probing flashlight beams.

A quick, whispered debate over whether to go up the deer trail or down resulted in a consensus to go down, seeking a clearing, or perhaps a stream. They walked quietly now, choosing each footfall with care. After fifteen minutes, Dave looked at his watch. "Charlie, it's going to be coming light soon. We gotta get settled."

His companion grunted, shining his flashlight up the slope. "See where that pine tree's down? Let's hunker down behind that. Mebbe later we can look around and see if there's a better place, so as we'll know for next time." Within five minutes, they had become one with the forest, invisible to even the most wary animals.

Or so they thought.

The first sound that reached their waiting ears was a soft step on the deer trail off to their right. The sky to the east was indigo now—clearly the dawn was coming—but all the lightening sky accomplished was to heighten the darkness in the forest; they could see nothing on the trail below them.

"Get ready on the light," Charlie said quietly. "Lemme see if I can nail this one."

"Ready," Dave whispered. "Anything stupid enough to stand still when the light goes on *deserves* to get shot."

"Not yet . . . not yet . . . *now!*" came the urgent whisper.

The powerful beam of the flashlight stabbed out, carving a tunnel in the darkness. The two men saw a powerfully muscled haunch, then a flash of white as the tail went up. The deer bounded once and was gone.

Charlie spat an unprintable curse under his breath. "Musta spooked him somehow."

"My God," Dave breathed reverently. "Did you see the *size* of that thing? I didn't know they made deer that big."

"Never seen one move like that, either. Critter must have springs in his feet. Still, can you imagine a rack like that over the fireplace?"

A quiet laugh next to him, more felt than heard. "Hell, I'd hafta get a bigger fireplace."

Ten minutes later they heard another deer. "My turn," Dave said. "No light."

The dawn was advanced enough that the forest floor could barely be seen. He raised his rifle into position, rested the barrel on the trunk of the fallen tree, and slid his finger through the trigger guard. A nearly invisible shape on the path paused, seemed to look their way, then leaped just as the flat crack of the rifle rent the still, early morning air.

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"Did you get 'im?" Charlie demanded.

"I think so."

"Well, let's go see. If he ain't dead yet, we'll finish him off."

But there was no blood on the trail, and they could hear nothing that sounded like the thrashing of a wounded animal.

"Well, hell, where'd he go?" Dave wanted to know. "I'm going down this way and see if I can see anything."

"You missed, man. Get over it. Let's get back behind the tree and see if another one comes along." With that, Charlie headed back up the slope.

Dave started down the path.

"Where the hell do you think you're goin'?" Charlie demanded when he noticed that Dave wasn't behind him.

"Tracking 'im. You wait here and get yourself one if you can. I'll call ahead when I come back so you'll know it's me."

Charlie was cursing under his breath in a steady stream. He watched the light of Dave's flashlight until he could see it no more. Just as he got settled in behind the tree he heard—or perhaps only imagined—a coughing grunt from the direction Dave had gone.

"Serve 'im right if he tripped over a root and fell," he grumbled under his breath.

The snap of a twig behind him was so sharp and so near that he started nearly out of his skin. He whirled, standing, gun barrel swinging just behind his line of sight.

A barely seen blur struck the back of his right hand where it gripped the stock of the rifle, shattering bones and slashing tendons. Screaming, he dropped the gun and fell to his knees. Quick steps retreated through the brush, headed diagonally uphill. He fumbled for the flashlight with his left hand and turned it on, aiming the beam at his right hand. What he saw horrified him.

"What the hell *got* me?" he whispered, trying desperately to think of something he could use to bandage his mangled hand. "Dave!" he bellowed. "*Dave!* Help, man, I'm hurt!"

He settled with his back against the tree, breathing fast and shallow. Dave would be pissed about losing his deer, but he'd understand once he saw his hand. This wasn't something he could just laugh off. He was going to need a doctor, maybe even a hospital.

But what in the name of God had hit him?

Feet approaching at a dead run. Too late it dawned on Charlie that the gait was wrong. He looked up just in time to see the silhouette of an enormous deer leaping into the air just six feet away. The left rear hoof caught him on the temple as the animal soared effortlessly over him. Coruscating lights exploded in his skull as he fell back against the trunk of the pine tree.

Shaking his head in an attempt to clear it, he staggered to his feet with the flashlight still clutched in his hand. He pinned it between his arm and torso and bent to pick up the gun, but the wave of dizziness and nausea that followed forced him back to his knees. Gasping, he levered himself back to his feet. He didn't want to leave the gun, but he had only one usable hand and it was either the gun or the flashlight and there wasn't enough light yet to see. He could always come back for the gun later.

He clambered awkwardly over the tree trunk and had gone less than ten steps when he heard the thunder of hooves again. He threw himself to the ground just as a hoof, or possibly an antler, parted his hair as it went by.

He was trying to come to terms with the idea that he was being attacked by a *deer*. The damned thing must be rabid or something. Still, there was something frightening about the accuracy of that first attack. The kicking hoof had struck precisely where it would do the most damage.

Charlie stumbled when he reached the deer path, regaining his balance only with difficulty. Two things occurred to

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him simultaneously: Dave wouldn't know where he'd gone, and the deer must know this path intimately. There was nothing that he could do about the deer—it was the surest, fastest way back to the truck. As for his friend ...

"Dave!" he yelled at the top of his lungs, head thrown back.

There was no answer.

Surely Dave couldn't have gone so far that he couldn't hear him. A sickening certainty came over him. Knowing that every step was taking him further from the truck, he turned and headed the way his friend had gone. It didn't take long to find him. One look and he knew that he could yell right in Dave's ear and never get a response.

Sickened, he turned and began a stumbling run back up the path. His balance was none too good, and the pain from his hand was almost more than he could bear, but there was a new emotion governing his actions now—fear.

The light from the flashlight swung crazily as he ran back up the path. Once, he thought he saw a brown pelt just at the limit of the beam, but he blinked and it was gone. Halfway up the mountain he discarded the flashlight. There was enough light now to pick out the trail and he needed his hand free.

The backside of the gate was the most welcome thing he'd ever seen in his life. He was going to make it ... it was just a territorial response ... he'd gotten beyond the edge of whatever the stupid deer thought of as its turf.

The impact came from behind, driving him face-forward into the ground just short of the gate. Charlie lay gasping, dead leaves fluttering in his breath. After what seemed like ages, he forced his eyes open, only to see the toes of a pair of expensive boots just an arms-length away.

"Dave?" he called weakly.

"I'm not Dave," came a man's voice. Rich, cultured, educated.

"Help me. I think my back is broken."

"I don't think so," came the disinterested reply. "Not yet, anyway. It seems that Bambi has taken a particular dislike to you."

"Bambi," Charlie repeated, not really a question, just affirming a fact.

"Bambi is really a very even-tempered animal, so I'm surprised to see him this angry. You must have been particularly naughty."

"He attacked me. Not fair."

"You attacked him first," the man pointed out. "Just as poachers always do. You think it's fair to be browsing a tasty bunch of leaves and feel a bullet rip through your lungs? Or perhaps it's fair to watch your mother be killed right in front of you? Take two football teams and let them face off at opposite ends of the field. A meeting of equals. That's fair. That's sport. A man with a gun versus an unarmed herbivore is not an equal match." He chuckled dryly. "At least it didn't used to be. It'll be a little closer now."

Charlie pushed against the ground, trying to get at least to his knees, but his right hand wouldn't support his weight. He took in a great, heaving breath and managed to use his left hand to roll onto his side. Maybe if he could move that much his back wasn't broken after all, but he was sure that he was hurt pretty badly all the same. "Closer? Closer how?" he mumbled.

The man beckoned and a massive deer walked slowly out of the forest to stand next to him, then another. Backlit by the approaching dawn, they seemed as big as elephants. The man's hand gently caressed one deer's ear. "Genetic engineering. Giving evolution a boost, you might say. I've been releasing these deer into the wild—a few here, a few there. They're born survivors, able ... and willing ... to take on a hunter. I've given them a sporting chance, if you'll pardon the expression, by tilting the fight or flight response a little more towards fight."

"But they'll overrun everything. There are too many already," Charlie whispered. "The experts—"

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"We'll let nature decide that," the man said firmly. "She's the expert, not you."

Charlie coughed, wiped his mouth, and saw dark blood on the back of his hand. "My lungs. I'm bleeding inside."

"What's wrong?" the man asked, his tone mocking. "Decided to pick on someone weaker than yourself and discovered too late that they were able to take care of themselves? Your idea of fairness is like that of a schoolyard bully's. You only hit those who can't hit back."

"Someone will stop you. This isn't right."

"Too late. I've already seeded core areas in six states. You probably haven't noticed, but there's already been a rise in 'hunting accidents.'"

"You can't do this."

The man ignored him, glancing at his watch. "You've had a nice little rest. Are you ready to run again?"

"Run?" Charlie gasped. "I can't run."

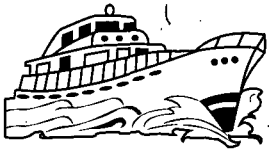
"Think how a deer feels with a bullet lodged in its gut. The pain is probably something like what you're feeling now. How does it feel to be on the receiving end for once?"

"Help me . . . please . . . you can't do this to me."

"I imagine that's what the deer you've shot would have said if they could have spoken," the man said contemptuously as he unlocked the gate and pushed it open. "Now . . . *get off my land!*"

Charlie looked at the deer, the man, then the open gate, and struggled painfully to his feet. He began staggering painfully towards freedom.

He did not hear the deer approaching stealthily from behind. ■



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Probability Zero

The Test

Kevin Levites

The aliens were welcomed everywhere they went.

There were ticker-tape parades, there was a mutual exchange of scientific knowledge, and a new era of understanding and tolerance was ushered in.

Mystical Michael—a former illusionist and stage magician turned psychic debunker—was unsurprised when he heard a tap on the door, and he—even though he had spent much of his adult life exposing phony psychics—briefly wondered if he had experienced a precognition.

"We have an application," said his assistant, as she let herself into his office.

"So? Somebody thinks they can take the million dollars?"

"It's two aliens, sir."

That gave him pause. His educational organization had a standing offer of one million dollars for anyone who could demonstrate a valid paranormal phenomena under controlled laboratory conditions.

"Rush the application through," he said, shaking his head which caused his flowing, white beard to sway back and forth.

"But . . . what if they use their advanced technology to cheat?" she asked.

"Fine," he answered. "I'd pay a million dollars to find out if the aliens cheat on their agreements—that's something worth knowing, don't you think?"

"You always have an answer," she replied.

The two aliens showed up on schedule, and The Mystical Michael had two Faraday cages set up in different rooms.

They signed an agreement which stated that they would demonstrate telepathy, and the Faraday cages prevented any radio- type device from transmitting hidden cues.

Mystical Michael shuffled a new deck of cards in the first room, and showed the alien a random card.

"King of Hearts," said the second alien, without a pause.

And so it went. At the end of the session, there was better than 90% accuracy.

"It seems like I owe you a million dollars," said Mystical Michael. "Your kind evolved with telepathy?"

"Yes, but it isn't the same as in the old days. My grandparents would have been a hundred percent accurate."

"Why is that?" he asked. "Has your use of electronic data transmission blunted your inborn skills and instincts?"

"Not quite," answered an alien. "My ancestors didn't have all of the pop-ups and spam to deal with." ■

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A FAREWELL TO COPENHAGEN?

This column is about experimental tests of the various interpretations of quantum mechanics. The question at issue is whether we can perform experiments that can show whether there is an "observer-created reality" as suggested by the Copenhagen Interpretation, or a peacock's tail of rapidly branching alternate universes, as suggested by the Many-Worlds Interpretation, or forward-backward in time handshakes, as suggested by the Transactional Interpretation? Until recently, I would have said that this was an impossible task, but a new experiment has changed my view, and I now believe that the Copenhagen and Many-Worlds Interpretations (at least as they are usually presented) have been falsified by experiment.

The physical theory of quantum mechanics describes the behavior of matter and energy at the smallest distances. It has been verified by more than 70 years of experiments, and it is trusted by working physicists and regularly used in the fields of atomic, nuclear, and particle physics. However, quantum mechanics is burdened by a dismaying array of alternative and mutually contradictory ways of interpreting its mathematical formalism. These include the orthodox Copenhagen Interpretation, the currently fashionable Many Worlds Interpretation, my own Transactional Interpretation, and a number of others.

Many (including me) have declared, with almost the certainty of a mathematical theorem, that it is impossible to distinguish between quantum interpretations with experimental tests. Reason: all interpretations describe the same mathematical formalism, and it is the formalism that makes the experimentally testable predictions. As it turns out, while this "theorem" is not wrong, it does contain a significant loophole. If an interpretation is *not completely consistent* with the mathematical formalism, it *can* be tested and indeed falsified. As we will see, that appears to be the situation with the Copenhagen and Many-Worlds Interpretations, among many others, while my own Transactional Interpretation easily survives the experimental test.

The experiment that appears to falsify these venerable and widely trusted interpretations of quantum mechanics is the Afshar Experiment. It is a new quantum test, just performed last year, which demonstrates the presence of complete interference in an unambiguous "which-way" measurement of the passage of light photons through a pair of pinholes. But before describing the Afshar Experiment, let us take a backward look at the Copenhagen Interpretation and Neils Bohr's famous Principle of Complementarity.

Quantum mechanics was first formulated independently by Erwin Schrödinger and Werner Heisenberg in the mid-1920s. Physicists usually have a mental picture of the underlying mechanisms within theory they are formulating, but Heisenberg had no such picture of behavior at the atomic level. With

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Modified Wheeler "which-way" experiment, after Afshar 2004.

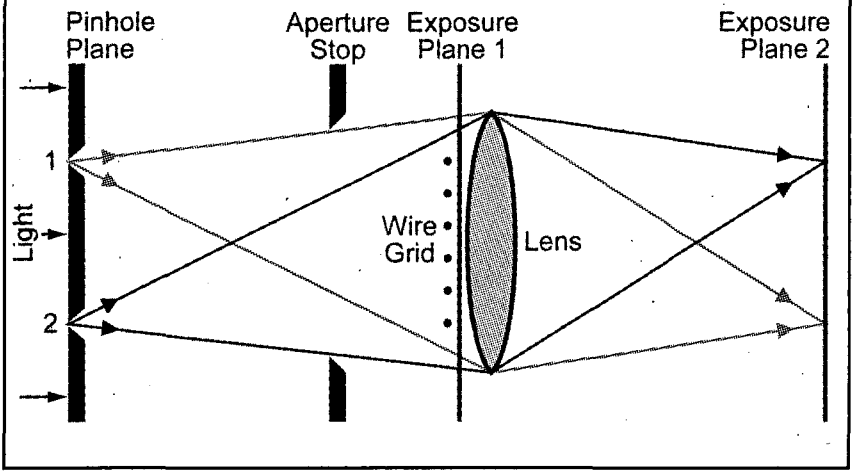

Illustration by Wolf Read

amazing intuition and remarkable good luck, he managed to invent a matrix-based mathematical structure that agreed with and predicted the data from most atomic physics measurements. On the other hand, Schrödinger did start from a definite picture in constructing his quantum wave mechanics. Making an analogy with massless electromagnetic waves, he constructed a similar wave equation describing particles (e.g., electrons) with a rest mass. However, it soon was demonstrated by Bohr and Heisenberg that while Schrödinger's mathematics was valid, his underlying mass-wave picture was unworkable, and he was forced to abandon it. The net result was that the new quantum mechanics was left as a theory with no underlying picture or mechanism. Moreover, its mathematics was saying some quite bizarre things about how matter and energy behaved at the atomic level, and there seemed no way of explaining this behavior.

In the Autumn of 1926, while Heisenberg was a lecturer at Bohr's Institute in Copenhagen, the two men walked the streets of the ancient city almost every day, arguing, gesturing, and sketching pictures and equations on random scraps of paper, as they struggled to come to grips with the puzzles and paradoxes that the quantum formalism presented. How could an object behave as both a particle and a wave? How could its wave description spread out in all directions, then "collapse" to a location where it was detected like a bubble that had been pricked. Did an electron smoothly make the transition from one atomic orbit to another or did it undergo a "quantum jump", abruptly disappearing from one orbit and appearing in the other? How could the occurrence of seemingly random quantum events be predicted?

The Copenhagen autumn phased into winter, and no solution was found. In February of 1927, Bohr went away on a skiing vacation, and while he was gone, Heisenberg discovered a key piece to the puzzle concealed in the mathematics of Schrödinger's wave mechanics. When one tried to "localize" the position of an electron by specifying its location

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more and more precisely, the mathematics required that the momentum (mass times velocity) of the electron must become less localized and more uncertain. One had to add more and more wave components with different momentum values to make the position peak sharper. Knowledge of position and momentum were like the two ends of a seesaw: lowering one raised the other. The product of the uncertainties in position and momentum could not be reduced below a lower limit, which was Planck's constant. The mathematics required that any attempt to do so must fail. This became the essence of the Heisenberg Uncertainty Principle, first published in early 1927.

When Bohr returned to Copenhagen, he was presented with the new idea. At first he was skeptical, because of problems with Heisenberg's "gamma ray microscope" example used in the paper, but he finally convinced himself that, example or not, the basic idea was correct. The Uncertainty Principle brought Bohr to a new insight into quantum behavior. Position and momentum were "complementary," in the sense that precise knowledge of one excluded knowledge of the other, yet they were jointly essential for a complete description of quantum events. Bohr extended the idea of complementary variables to energy and time and to particle and wave behavior. One must choose either the particle mode, with localized positions, trajectories, and energy quanta, or the wave mode, with spreading wave functions, delocalization and interference. The Uncertainty Principle allowed both descriptions within the same mathematical framework because each excluded the other. Bohr's Complementarity and Heisenberg's Uncertainty, along with the statistical interpretation of Schrödinger's wave functions and the view of the wave function as observer knowledge were all interconnected to form the new Copenhagen Interpretation.

In Bohr's words: "... we are presented with a choice of either tracing the path of the particle, or observing interference effects ... we have to do with a typical example of how the complementary phenomena appear under mutually exclusive experimental arrangements." In the context of a two-slit *welcher weg* (which-way) experiment, the Principle of Complementarity dictates "the observation of an interference pattern and the acquisition of *which-way* information are mutually exclusive." By 1927 the Copenhagen Interpretation was the big news in physics and the subject of well-attended lectures by Bohr, Born, and Heisenberg. In the next decade, through many more lectures and demonstrations of the effectiveness of the ideas and despite the objections of Albert Einstein, it was canonized as the Standard Interpretation of quantum mechanics, and it has held this somewhat shaky position ever since.

The Afshar experiment was first performed last year by Shariar S. Afshar and repeated while he was a Visiting Scientist at Harvard. In a very subtle way it directly tests the Copenhagen assertion that the observation of an interference pattern and the acquisition of particle path *which-way* information are mutually exclusive. The experiment consists of two pinholes in an opaque sheet illuminated by a laser. The light passing through the pinholes forms an interference pattern, a zebra-stripe set of maxima and zeroes of light intensity that can be recorded by a digital camera. The precise locations of the interference minimum positions, the places where the light intensity goes to zero, are carefully measured and recorded.

Behind the plane where the interference pattern forms, Afshar places a lens that forms an image of each pinhole at a second plane. A light flash observed at image #1 on this plane indicates unambiguously that a photon of light has passed through pinhole #1, and a flash at image #2 similarly indicates that the

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photon has passed through pinhole #2. Observation of the photon flashes therefore provides particle path *which-way* information, as described by Bohr. According to the Copenhagen Interpretation, in this situation all wave-mode interference effects must be excluded.

However, at this point, Afshar introduces a new element to the experiment.[1] He places one or more wires at the previously measured positions of the interference minima. In one such setup, if the wire plane is uniformly illuminated, the wires absorb about 6% of the light. Then Afshar measures the difference in the light received at the pinhole images with and without the wires in place.

We are led by the Copenhagen Interpretation to expect that the positions of the interference minima should have no particular significance, and that the wires should intercept 6% of the light they do for uniform illumination. Similarly, the usual form of the Many Worlds Interpretation of quantum mechanics leads us to expect 6% interception and no interference, since a photon detected at image #1 is in one universe while the same photon detected at image #2 is in another universe, and since the two "worlds" are distinguished by different physical outcomes, they should not interfere.

However, what Afshar observes is that the amount of light intercepted by the wires is very small, consistent with 0% interception. There are still locations of zero intensity and the wave interference pattern is still present in the *which-way* measurement. Wires which are placed at the zero-intensity locations of the interference minima intercept no light. Thus, it appears that both the Copenhagen Interpretation and the Many-Worlds Interpretation have been falsified by experiment.

Does this mean that the theory of quantum mechanics has also been falsified? No indeed! The quantum formalism has no problem in predicting the Afshar result. A simple quantum mechanical calculation using the standard formalism shows that the wires should intercept only a very small fraction of the light. The problem encountered by the Copenhagen and Many-Worlds Interpretations is that the Afshar Experiment has identified a situation in which these popular interpretations of quantum mechanics are inconsistent with the quantum formalism itself.

What about the Transactional Interpretation, which describes each quantum process as a handshake between a normal "offer" wave (ψ) and a back-in-time advanced "confirmation" wave (ψ^*)? The offer waves from the laser pass through both pinholes and cancel at the positions of the zeroes in the interference pattern. Therefore, no transactions can form at these locations, and the wires can intercept only a very small amount of light. Thus, the Transactional interpretation is completely consistent with the results of the Afshar Experiment and with the quantum formalism.

Does this mean that the Copenhagen and Many Worlds Interpretations, having been falsified by experiment, must be abandoned? Does it mean that the physics community must turn to an interpretation like the Transactional Interpretation that is consistent with the Afshar results? Perhaps. I predict that a new generation of "Quantum Lawyers" will begin to populate the physics literature with arguments challenging what "is" is and claiming that the wounded interpretations never said that interference should be completely absent in a quantum *which-way* measurement. And most practicing physicists who learned the Copenhagen Interpretation at the knee of an old and beloved professor will not abandon that mode of thinking, even if it is found to be inconsistent with the formalism and with experiment.

But nevertheless, the rules of the game have changed. There *is* a way of distinguishing between interpretations of quantum mechanics. It will take some

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time for the dust to settle, but I am confident that when it does we will have interpretations of quantum mechanics that are on a sounder footing than the ones presently embraced by most of the physics community. ■

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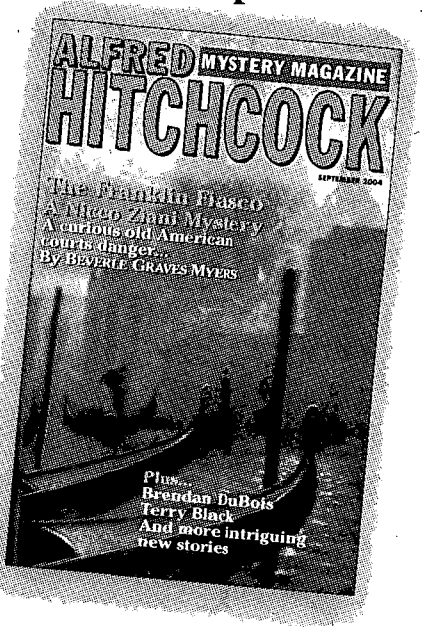

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Savant Songs

Brenda Cooper

Illustration by Sherlock

Who better than one who lives in two worlds to study the slippery interfaces between universes?

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I loved Elsa; the soaring tinkle of her rare laughter, the marbled blue of her eyes, the spray of freckles across her nose. Her mind. The first, deepest attraction; the hardest challenge. She flew with her mental intensity, taking me places I'd never been before, outdistancing me, searching the mathematical structures of string theory and mbranes, following n-dimensional folds across multiple universes. I loved her the way one loves the rarest Australian black opal or the view from the top of Mount Everest. Elsa's rarity was its own attraction. There are very few female savants.

She captured me whole when I was her physics grad student, starting in 2001, nine years before break-through.

Ten years ago last week, I walked into Elsa's office. She stood with her back to me, staring out her window. She didn't move at all as I snicked the door shut and scraped the chair legs. I coughed. Nothing. She might have been a statue. Her straw-colored hair hung in a long braid, just touching her slender hips, fastened with a violet beaded loop, the kind little girls wore. Her arms hung loosely from her pink t-shirt, above faded jeans and Birkenstocks.

"Hello?" I spoke tentatively. "Professor Hill?" Was she all right? I'd never seen such stillness in anything but a sleeping child.

Louder. "Professor? I'm Adam Giles, here for an interview."

She finally turned and stepped daintily over to her desk, curling up in the big scratched leather chair behind her empty desk. Her gaze fastened on my eyes, as if they were all she saw in that moment. "Do you know what the word atom means?"

I blinked. She didn't. A warm breeze from the open windows blew stray strands of her hair across her face.

I struggled for the right answer, pinned by her gaze. She was an autistic savant. Literal. "Indivisible."

"Why?"

I thought about it. Atoms are made of protons, electrons, and neutrons, and ever-infinitely smaller things. "It means they didn't know any better when they named them. They couldn't see anything smaller yet."

"It means they were scared of anything smaller. They tried to make the word a fence. They thought that if they called atoms indivisible, they could make them indivisible." Her gaze still hadn't wavered. Her voice was high and firm, a soprano song even when she talked. I'd researched autistics, researched Elsa herself on the web. In physics, she was brilliant. She threw ideas right and left, half silly and wrong, half cutting-edge breakthroughs. If she accepted me, I would help the university winnow, feed her ideas to people who would follow them for years. One of her interviewers had summed her up by saying, "Talk to Elsa about physics, and all you see is the savant. The autistic exists over dinner."

No grad student had lasted more than three months with her. I needed to last with her; my dissertation was based on her ideas. Whether she screamed or cried or just made me work, however strange she might be, I wanted—needed—to explore what she explored.

She kept going. "Scientists make fences with ideas. Accidentally. Do you like to jump fences?"

"Yes."

"You'll do." She stood.

"Don't you want to know about my dissertation?"

"You're working on multiverses. It's the only reason you can possibly have chosen me."

She had a point. But multiverses was a rather broad subject. Mtheory: the latest plausible theory of everything, the current holy grail of physics. We live in universes made of 11 dimensions, called (mem)branes. We can render them with math, but settle for flat representations like folded shapes and balls full of air when we try to draw them in the few dimensions we can actually see. If you look at our pitiful drawings, we appear to live

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as holograms on flat sheets of see-through paper.

From that strange interview, I spent the next year near her every day, pounding away on my dissertation late at night, only giving myself Saturday nights for beer and chat with friends.

It was hard at first. Some days she talked endlessly about her most recent obsession, only not to me. She talked to herself, to the walls, to the windows, to the printers. I might as well have been inanimate. I wandered the lab behind her, taking notes. It was like following a six-year-old. She mumbled of memories from multiple universes, alternate histories, alternate futures. The first time I really understood her, months into following her, she stopped suddenly in the middle of one of her monologues, looking directly at me, as if today she saw me, and said, "Memory is a symphony call answered by the infinite databases on all the brane universes. We just need to hear the right notes, or make the right notes in an out-call, like requesting a certain table from a cosmic database."

I learned she cared little for food, or weather, or even holidays. I learned never to change the location of anything in the lab, and that if she changed it, she never forgot the change. Even pencils had places. I had to hold her coat out to her when she left, trail it along her arm so she'd notice it, and then she'd shrug into it, safe from the New England weather until she made it across campus to the little brownstone apartment the university provided for her.

I didn't care whether she ignored me or made me the center of her focus. Months passed when she worked with me by her side, when she seemed astoundingly normal, and guided me to new levels of understanding. But even when she fell into herself, when she wandered and talked to walls, I loved to watch her. Elsa had a dancer's grace, flowing easily, precisely, around every physical obstacle while her mind played in math jungle gyms and her hair glowed in the overhead lights. She was the fairy queen of physics, and I stayed with her, became her acolyte, her Watson, her constant companion.

Scientific dignitaries visited her, and reporters, and the Physics Chair, and I translated. "No, she thinks it is a music database. Or something like that. Related to Sheldrake's morphogenetic fields? A little. To Jung? She says he was too simple—it's not a collective unconscious. It's a collective database, a hologram, keyed to music. A bridge between eleven dimensions. Yes, some dimensions are too small to see. Elsa says size is an illusion." I illustrated it the way she illustrated it to me once; plucking a hair from my head. "There are a million universes in here. And we are in here, too. Perhaps." Whoever I was talking to would look puzzled, or awed, or angry at this, and I would shake my head. "No, I don't fully understand it."

Elsa nodded when I spoke, or when I changed something she'd said in physics-speak to English. Sometimes her hand fluttered to my arm, her thin fingers brushed my skin, and a nearly electric warmth surged through me.

There was an argument over my dissertation. One professor said the work I was doing was impossible and dangerous, another said it was Elsa's work and not my own, but two others stood up for me. Elsa was there, of course, staring at the ceiling, scribbling on her tablet PC, barely engaged in the argument. I fretted. She only saw me on some days; if this were a day that I was furniture, would she vote for me? But at the right moment, she raised her voice, and said, "Adam is an exemplary student, and more than that, an exemplary physicist. The ideas put forward here are astonishing, and only partly based on my work. All of us build on each other. Give the man his doctorate so we can get back to work."

And so I became a Doctor of Physics.

The Kiley-James Foundation gave me enough money to stick with Elsa for five more years as a post-doc. Our work was

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being closely followed by other physicists; two articles appeared in journals, and a watered-down version was written for a popular science magazine. I would have stayed without the money.

Six years after I met Elsa, two years after my Doctorate, and three grants later, the university gave her PI, short for Physics Intelligence, an AI designed for her by a colleague, delivered with basic intelligence programming and the full physics slate through master's-level work. PI has multiple interfaces, including a hologram that can be designed by the user. Elsa loved that interface, making PI a girl, growing the age of the hologram as PI obtained new knowledge.

Elsa and I spent a year feeding Elsa's ideas about string theory into PI, filling her with data about the shapes of multiple brane universes. It was all theory, all arguments yet unanswered, all beyond anything I could visualize, even though the math flowed easily. I thought we were done. But next, Elsa and I spent a month feeding her all the symphonies in the world music database; Brahms and Mozart, Bruckner and Dvorak, and then other music like Yo Yo Ma and Carlos Nakai. Lastly, after n-dimensional math, after music, we fed PI literature. We fed her stories of humans, biographies, science fiction, mystery, even romance. Simply put, we offered PI more than math and science, we offered her ourselves.

One Sunday morning, near the end of the year-of-feeding-PI, I slipped and slid my way through icy streets, clutching two coffees, and pushed open the door with my foot. Elsa sat on the floor, cross-legged, staring at the little programmable hologram of PI. She was wearing the same jeans and sweatshirt from Saturday, and her braid had come undone, so her hair floated across her shoulders and touched the floor. She hummed softly. I strained, hearing something else. I bent down. The PI hologram hummed as well, sounds I had never heard a human voice make. I realized Elsa was trying for the same noises, her throat unable to force the inhuman sounds.

"Elsa?"

She ignored me. So it would be one of those mornings. I set her coffee down next to her, and her hand strayed toward it momentarily, then returned to her knee. I watched her as I drank my coffee and organized notes on questions and theories to feed into PI. Elsa hummed for at least an hour, until her voice would no longer work at all. I took a bottle of water and curled her hands around it, and she raised it to dry cracked lips and drank deeply, shuddering.

She blinked and looked at me. "Good morning, Adam. It is morning?"

"Shhh," I said, "Shhhhh. It's time for you to sleep." I tugged gently on her arm, and Elsa stood shakily, stamping her feet as if they'd gone to sleep. She followed me meekly to a long thin cot we'd wedged between two desks and under a printer, and fell instantly asleep. I covered her with her own overcoat, tucking it around her legs, then threw my spare sweater over her feet, which were sticking out from the overcoat. In sleep, she looked younger, as if the spider web of wrinkles around her mouth and eyes had disappeared into her dreams.

I sat where she had sat, staring at PI. Elsa had set the hologram to be a dancer, and even though PI was light and form, I imagined that she must be cold in her thin leotard. She had been sized to three feet, just tall enough that I gazed into her eyes. She still hummed, her throat, of course, not challenged. As I listened, I realized there were more sounds than a hum; she was accompanied by a complex electronic orchestra, much of it sounding like instruments I had never heard before. The total affect was chaotic and haunting, sometimes cacophonous.

"PI?"

She stopped. "Yes, Adam?"

"What are you doing?"

"Playing what I hear when I search for myself."

I tried to clarify. "You are looking for an AI named PI in another universe?"

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"I don't care about the name. I am searching for a song that approximates my story." The hologram smiled softly, a skill it had been taught to help it interact with people. She raised her hands up above her head, and her left leg rose behind her, so I could see the toe-shoe above her head, and she hopped three times *en pointe*, and returned to standing.

I shook my head at the odd image. "Across branes?" Then I laughed. "Or are you looking for an AI ballet dancer?"

"My story is not ballet. Elsa is simply feeding me dance and movement this week. I learned opera yesterday, and musicals." She smiled and did a little bow. "And of course across branes. We believe my self cannot exist twice in the same brane."

"Is Elsa also looking for her self?"

"She can hear her music, and she can feed it to me so I can play it, but she cannot make it herself." Now PI was frowning, and tears coursed down her cheeks.

"PI, does that matter?"

The tears disappeared, no trace, and PI looked solemn. "It may mean that humans cannot access their other selves. They cannot tune themselves well enough to the cosmic symphony to find themselves. From stories, it seems like this is true. Humans want to find themselves badly enough to make hundreds of religions, to meditate for years, to take hallucinogenic drugs. They do not appear to succeed."

I drummed my fingers, pondering the implications. "But you can?"

"I am operating on the theory that I cannot, and am trying to disprove it. Elsa is doing the same."

"I am supposed to feed you data today; two new ideas about the singularity before the big bang."

"I am not a calculator." She raised her bare arms above her head and flipped backwards, the ballet skirt looking ridiculous during a back flip. She was humming as she landed perfectly. "See?"

"All right. Look, PI, you're making me shiver. Can you put on some warmer clothes?"

She laughed, an imitation of Elsa's laugh, and I smiled as an overcoat appeared, just like the soft one covering Elsa now, in her sleep, down to the thick waist-band and the big silver temperature-sensing buttons.

"Thank you."

I picked up Elsa's cold coffee and set it by the microwave, returning to my desk. The humming and the symphony started again, so softly it was simply background, and I spent the next four hours pouring data carefully into PI, setting initial linkages so they could be followed and completed, watching the display show connections being made, information filed and cross-referenced, relevancy assigned. I rubbed my eyes, feeling a sudden desire for warm food and cold beer.

I shook Elsa's shoulder gently, rousing her. She started to hum. I shook her again. "Come on, let's feed you."

In the past few years she had taken to following my lead in daily life the way I followed hers in the lab. I helped her shrug into the overcoat, handed her a knit hat, and wrapped myself in my gray coat, gray scarf, and navy cap. Snow fell softly, silencing the university. We walked across the commons, our feet making fresh prints in an inch of new snow, Elsa's hair lying wet and snow-covered on the outside of her coat. I should have made her braid it back, kept most of it dry.

Sunlight from a small hole in the clouds touched her cheek, illuminated the snow on her hair, and then trailed off to brighten the tops of dead grass peeking from the snowy lawn. I smiled and put a hand on her back, guiding her. She laughed, and took my hand, a friendly gesture, a connection.

Often it happened that way after she separated herself from the world—she rose from days of monologues or data work and seemed normal, reaching out, wanting companionship and comfort. Other professors came to her from time to time, sometimes staying and talking

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long into the night, even laughing, sometimes noting her mood and disappearing. Department chairs stopped by and funding institutions sent representatives. They were all interested in her ideas; some worked with AIs like PI, but focused more singly on music and math.

I remained the man who saw her for herself, cared whether she wore a coat, brought her grapes and apples and coffee. Family. It made me smile.

The scent of chili and cornbread warmed the air outside of Joe's Grill, and Elsa and I both smiled, eyes locking, and squeezed each other's hands. I felt absurdly like skipping, but we were already at the door. The place was nearly empty. Elsa chose a table by the window, and the waiter, who knew us, brought a pitcher of dark beer, then returned with two bowls of chili and a single plate heaped with cornbread.

We ate in pleasant silence until I scraped the last chili from my bowl with the last piece of cornbread. Elsa, typically, had barely sipped at her beer. She'd finished her food, though; a good sign. Some days, I almost had to feed her. "I talked to PI today," I said. "She said you are both trying to disprove the theory that you don't exist anywhere else."

"I am looking for myself. She is looking for herself." Elsa took a tiny sip of beer from her untouched glass, and I finished my first glass and poured a second one.

I had been puzzling over it in my head all afternoon. "Okay. One theory says we make other universes every time we make a choice. You finish your beer, or you don't. There is a universe where you're slightly drunk, and in another one—probably this one—you are not. A million selves. That's easy. Maybe. Both of you are similar and maybe both of you are you."

She nodded, looking uninterested, as if her mind was leaving again. A fleck of beer foam rested on her top lip.

I grabbed her hand, squeezing it, trying to keep her in the moment, in my moment. "But there is more interest now in the idea that other universes exist because the same initial conditions existed a million times, and so similar things happened, and another you, another me, another PI, they all exist. Exactly like we are now."

She licked the fingers of her free hand, then squeezed my hand with the one of hers I was holding. "It's simply a matter of branching. One idea says a million tiny branches happen every day. Another says there are long branches. It's about the size of the branches and the number of branches."

I remembered my father trying to teach me ninth-grade algebra. He'd point at an equation that totally perplexed me, the tip of his pencil wavering, and say "You just have to understand equals. Don't you understand equals?" And he'd solve the equation with no intermediate steps and I'd have to find a tutor anyway, someone slow enough for me to follow. There was no tutor except Elsa now, not in this subject.

She looked at me, and said, "You're caught up in size, Adam. It's as dangerous as being caught up in time. They're both constructs."

I wasn't thinking about size at all. "But . . . but one multiverse, the first one, drunk and not-drunk, tells a million stories about me. The second multiverse doesn't illustrate free-will at all."

"I bet—" she raised her glass, "—on the universe made of stories." She drank down all of her beer, and then another glass, something she'd never done before, and stood up, wobbling a little, and I took her elbow, guiding her out the door and across the lawn.

We were halfway across, Elsa leaning on my arm, when she stopped so we stood in the near-darkness, snow falling all around us. She reached an arm up and curled her wrist around the back of my head, pulling my face down into a kiss. Her lips were cool and soft, and we kissed hungrily, like two children finally allowed out for recess. Her lips tasted like sweet hot peppers and beer. It was the

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only time she ever kissed me.

What happened that night in some other multiverse?

For the next three weeks, Elsa worked with PI as if they were in a race. Her face shone with energy, and even when she grew visibly tired, her eyes danced. I hovered around the edges, watching. Elsa was so deeply enthralled that loud noises made her leap and glare at me, and I walked carefully. At first, PI and Elsa continued with audible noise, like the humming/symphony, played so softly I could barely hear it. Then PI started generating white noise, taking the small background sounds with everything important filtered out from the very room around us. Then I heard silence, and Elsa and PI talked in light. I took to watching the conversation on my own interface with PI, which amounted to watching lights and words flash on and off, strings drawn between ideas and concepts and even poems. I could not follow them, but the relationships they drew seemed right, and when I let go of the attempt to understand there was a flow that I could feel, as if a river of meaning coursed along the display in front of me.

Almost every day, Elsa found a new thing to include in PI's expanding web of connectivity. Scientology. Cargo Cults. Early cave paintings.

I captured all of it, recording the data for others to dig through. For myself, I tried to keep up with them, puffing along uphill, weighed down by inability to focus. I kept Elsa fed, but she refused to go home, and I bought a second cot so that she would not be alone.

We didn't make the first breakthrough.

Outside the window, morning sun stabbed the ice on the branches with brilliant points of light. The office smelled like stale coffee and sweat. My eyelids were heavy and uncooperative, my brain fuzzing gently in and out of sleep. Elsa was still sleeping, curled underneath blankets I'd brought from home for her, one foot stuck out at an odd angle. The display in front of me sprang awake on its own, a pulsing green and blue color, PI's call for attention. "Yes, PI?"

"Something touched me. Wake Elsa."

I didn't understand. "All right." I struggled up out of the chair, wishing I'd already made my coffee run. "Just a minute. Make yourself seen, all right?" I always preferred to interact with the hologram rather than the flat display. It gave PI more options as well; she could communicate more like a human. AI body language.

I whispered in Elsa's ear. "PI says something touched her."

Elsa sat straight up, wide-eyed, and glanced at the hologram display. PI was seated, her image dressed in jeans and a tank top, banging her legs against the edge of a holographic chair, indicating impatience. "I wasn't even out-calling, I was just humming my own songs," she blurted out, "and an answer came. An AI just like me, with a scientist named Elsa. Seconds only, like a crack opened and closed. I could only talk to the AI, of course, and I was sending her the data stream from our last few weeks when the connection broke."

"Did you get a time?" Elsa asked quietly.

The PI image frowned. "I asked, but the connection snapped before an answer came."

"Can you replay the conversation?"

The image shook its head. I checked. The last few moments before PI flashed at me were silent. "There's nothing. Just state data, indicating excitement."

"That's okay," Elsa said, "we'll work on that." She plucked at a tangle in her hair. "PI, what did you feel?"

It was a strange question to ask an AI.

"Bigger. Pulled. Attracted to the other one of me. But at the same time, I knew—" the word 'knew' drew itself over her head in three dimensions, for emphasis, surely for me—"I knew that I couldn't actually get close. As if there were a physical barrier between branes."

Elsa pursed her lips. I went out for coffee.

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When I came back in, handing Elsa a cup, she took it and sipped quietly. "We have to make it happen again," she said. "Or hope it happens again. We didn't start it."

"Make what happen? I don't get it, not yet."

"The coffee is hot, right?"

I smiled at her. "That's a good thing."

"But it's not true." She sipped her own coffee carefully. "Touch your knee."

I did.

"What did you touch?"

"My knee."

"No, you touched a fence. You've got all the theory, all the math. You know we are really light and sound, thinner than that hologram of PI." She glanced over at PI's image, which was clear enough that I could make out the walls behind it. "Well, PI being touched by herself—in another universe - means that we are light, and sound, and infinite." Elsa stopped for a moment, her eyes nearly glazing over. "I thought a data construct could do what we cannot. Or at least, could lead the way." She set the coffee down and stood, staring out the window, posed very much like I first saw her. "I intend to follow her into my own stories. If I can."

"Into your stories?"

"Remember the night I drank the beer? History split, and the normal me—since I don't usually drink much—split off into a different universe. I'm splitting myself all the time, and so are you."

"Theoretically."

"Theoretically. I tell PI daily to search for me by searching for herself. Millions of PIs and millions of Elsas, and probably millions of Adams, all looking for each other. The more culture, the more ideas we feed PI, the more likely she is to synthesize the key. Our PI did not, or she would have made first contact. But in another story, in another place, I fed PI the key."

She pursed her lips and stared out the window at the icy branches, water dripping off them as the day warmed up. She spoke again. "Perhaps another Adam fed her the key."

It took another year to develop enough data to create a paper, to replicate any results at all. The first two times were other PIs finding our PI, three separate PIs, or four, depending on how you count. They learned to hold the connections open, to broaden them, to find more. Together PI and Elsa were able to prove they were in the same time, in other spaces. In other words, they were not histories of each other, or futures of each other. Multiverses. The proof was mathematical.

I wrote the paper, putting her name first, even though most of the data came from PI, who of course, wasn't listed as an author. They'd gone well past me now. Elsa with her perfect savant focus and PI, who wasn't held back by biology at all.

More people came to visit, a steadier stream. We used some extra money I'd squirreled away in an R&D account to buy an electronic calendar and carefully manage access, blocking time for ourselves. It bought us whole days, uninterrupted, here and there. Elsa could still pull herself together for public visits, but she retreated entirely on the quiet days, not wanting touch or sound. She talked to PI, to multiple PIs via our PI, and I sat, outside of her emotions, fenced away by her brilliant mind. She often smiled at nothing, or rather, at something I could not hear or see.

There were multiple Adams, although not always. Sometimes the assistant was someone else. In one universe, I had died the previous spring and there was a new person helping that Elsa, that PI. It didn't seem to bother Elsa at all. It sent me out for a pitcher of beer.

My head spun. This was what I had always wanted, except what I truly wanted had changed to chili and cornbread with my Elsa.

It was two years ago. I remember the date, April 12, 2011. I watched her as she looked out the open window. Tears streamed down her face. Her shoulders shook.

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I had never seen her cry. Not in ten years.

I came up behind her, and put my arms around her. She flinched inward, as if wanting to escape from my embrace. I held her anyway, put my cheek against her hair, looked down through half-closed eyes and watched her freckles. She had been friendly, funny, lost, distant, but never, never afraid. I held her tighter, and stroked her hair, trembling myself. What had she found?

It took a while, but finally she looked me in the eyes, and said, "I can't get through. Only PI can. The PIs. Other AIs. Nothing I do lets me get through. The other Elsas can't either. As brilliant as we are, as strange, as blessed, we can't open the door. The notes aren't there—my body ... my body gets in the way." She blinked, and two fresh tears fell down her cheeks. I wanted to lick them off.

"I'm sure now that only pure data can get through. Humans will not become pure data for years yet, past my lifetime. I will never see what PI sees." She turned around then, pulled herself into me, and sobbed until my shirt was soaked and my feet were heavy from standing in one place.

The smell of lawn wet with spring rain blew in the window, and I heard students laughing below us, teasing each other.

Then, in one of her lightning changes of mood, Elsa pushed away from me and started out the door. I thrust her coat at her, and she grabbed it with one hand, pulling the door shut behind her, leaving no invitation for me to follow.

I went home that night, and the next day, Elsa didn't show. I waited impatiently until afternoon, finally walking to her brownstone. The door pushed open, unlocked. Elsa's things remained, all in their accustomed places.

I walked back across campus, blue sky above me, the grass under my feet damp and greening up. I tore the door open. "PI! Where the hell is Elsa?"

PI's interface was a little boy with a fishing pole, a holo I'd chosen. I didn't want it now. "Bring the old man!"

PI morphed to the dancer instead, sitting on a rock, feet crossed daintily. "I don't know where she's gone."

"Damn it! I'm worried. The last time I saw her, she cried. She thought she'd never get across."

"I know that."

Of course. PI was always on.

Cool spring rain flooded the gutters and made small rivers in the university lawns. I bundled up, and went every place we had ever gone together. Restaurants. Bookstores. The old music shop on the boulevard with garish purple posters in the window.

Two joggers found her body the next morning, sitting against a tree. The police took me to her, to identify her. She looked incredibly young, and could have been sleeping except for her stillness and the cold. She had put her coat on, only now it was soaked and heavy and couldn't possibly keep her warm. There was no sign of foul play. Rain covered her cheeks like tears, and I bent down and slid my forefinger across her face before a policeman asked me to step back.

An older policeman and a young woman in plainclothes questioned me, and made me spend a week out of the lab. When I went back to work, everything was out of place. Not much; people had been respectful. Elsa would have noticed the pencil cup three inches from its corner, the stack of books on the wrong shelf, the cups from the sink set back out of order.

PI was waiting for me, as the old man. She looked up solemnly, clearly aware of what happened. "Three of them."

"What?"

"I found three Elsas who killed themselves. Two disappeared." She is crying, her eyes red in the old man's face.

The other Elsas continue to work, and I talk with them through PI. I keep myself in good shape, running every morning. I'm younger than the Elsas. Perhaps I will be able to cross before I die. ■

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Small Moments in Time

John G. Hemry

Given godlike powers,
you must decide whether to use them—
and either choice has huge consequences.

The odd truth of working as a temporal interventionist is that some there-and-thens are better than others. History books make the past sound like one thrilling event after another. But for every Shootout-at-the-OK-Corral moment of excitement, there are days, weeks, months and years of people just doing the things that people have to do. Things important enough to keep them alive and their society functioning. Plenty of the all-too-usual human drama, but not the stuff of great historical drama. Most people don't believe that when I tell them, though.

I leaned against the window frame, squinting against a dry, hot wind blowing across the Kansas prairie and into my face, bringing the gritty taste of fine dust into my mouth whenever I licked my lips. Sometimes I think about the fact that the dust might literally have once been part of someone I knew in another long ago there-and-then. Usually, I try not to think about that, but something about the apparently endless prairie and the seemingly endless wind brought it to mind now, along with memories of the Earps and their brief moment in another western town where the wind had always seemed to be blowing hard.

The thin curtain drawn back from the hotel window fluttered in that wind. From my second-story room, I could see down the main drag of Junction City, Kansas circa July, 1918 A.D. Such as it was. Lots of wood structures, some brick and some sandstone block construction, primitive internal combustion-driven automobiles contending for space on the road with horse-drawn wagons, and a few clouds in a faded blue sky as yet contaminated mainly only by that damned dust.

A cluster of men wearing drab military uniforms came around a corner, offering a small reminder of the hosts currently grinding each other into the bloody mud of Europe, just as they'd been doing for the last four years here

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and now. I knew that particular war was finally drawing to a close. If I wanted to, I could find out the names of the soldiers I saw and learn which of them would die before the end of the war. I didn't want to.

Instead, I gathered up the coat local fashion demanded I wear despite the weather, wished I could do without the neck-tie local fashion likewise demanded, took a drink of the lukewarm water remaining in the pitcher the room boasted instead of a sink, and headed for one of the local grain suppliers.

I had to walk into the sun to get there, but local fashion at least had the wisdom to also demand hats with brims, so I was protected from the worst of the glare. "Jeannie. Confirm my directions to this place."

"One more block down, then two blocks south. Just before the railroad track."

"Thanks." Jeannie, my implanted personal assistant, had a wonderful navigational package. A female friend of mine had once remarked that my having Jeannie inside me was perfect for a man, since it meant I could ask for directions without anyone knowing I'd done so.

The grain supply office was filled with the musty smell of a different kind of dust, this from the endless bushels of wheat which passed through the office or the nearby grain elevators. I could see the grain dust as well, clouds of it floating gently in the air currents, as I walked down the line of sample bags, looking for specific seeds for wheat variants which had gone extinct between now and the future I came from. A lot of people needed those extinct plant seeds, and needed them enough to be willing to pay the large sum needed to bring me to Kansas in the early years of the twentieth century.

I found a couple of wheat varieties listed among the requirements Jeannie kept track of for me, as well as a bonus rye variant, and purchased sample bags with some of the better-than-real counterfeit local currency I'd outfitted myself with. Such are the exciting adventures of a temporal interventionist.

I stopped by the town's other major grain supplier and found a few more samples I needed, then walked back to the hotel to drop off my purchases and have lunch there. Lunch turned out to be fried chicken. Again. But at least it wasn't chicken and dumplings. Again. The iced tea made up for it, though. Downtime farmers know how to make iced tea like nobody else.

Conversation among the other hotel guests was mostly about the war, of course. One of the couples was put out because they couldn't see their son, who was at the big Army base nearby. I shrugged it off as the usual sort of wartime security, until they said the word "quarantine."

Downtime diseases make any temporal interventionist nervous. You can't develop an immunity or sometimes even get a vaccination for some bug that died out centuries before you were born. Even if decent medical records existed for the period, those records were only as good as the medical theory and technology of the time. And primitive armies were notorious for attracting epidemics. The little nanobugs that helped out my immune system could deal with a lot of things, but you never knew just how virulent something unknown might turn out to be. I hurriedly finished my lunch and headed for my next objective in town, determined to get my work done and then out of here and now as fast as possible.

"Jeannie, did any serious disease outbreaks take place in or near Junction City, Kansas in 1918 A.D.?"

"Only the Spanish Influenza."

Anyone watching would've seen me jerk with momentary shock. "Is that all?" It'd been a long time since the Spanish Influenza when I'd first learned about it, but it still held the dubious record of being the deadliest epidemic in history, which was why I immediately recog-

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nized the term. "Here?"

"It apparently originated in Camp Funston."

"I thought the big Army installation here was named Fort Riley."

"That's correct."

I felt briefly reassured, then remembered why "artificial intelligence" is still a disparaging term. "Is Camp Funston related in any way to Fort Riley?"

"Camp Funston is located on Fort Riley."

"Thanks for elaborating. How serious is the threat at this time and place?"

Jeannie, as always, sounded authoritative and calm. "Very limited, which is why there is no disease warning flagged on this here-and-now. The early phases of the Spanish Influenza were widespread in some areas but had low mortality rates consistent with usual influenza outbreaks."

That was reassuring. "When did the later phases begin?"

"August, 1918."

Plenty of time to work with. Still . . . "Here?"

"No. Simultaneous or near-simultaneous outbreaks of a much more deadly variant of Spanish Influenza will erupt in Freetown in Sierra Leone, Brest in France, and Boston in the United States."

That was even more reassuring, but also odd. "Simultaneous or near-simultaneous outbreaks, in three different widely-dispersed areas, of the same deadly variant?"

"Yes."

"How could . . . how did that happen?"

"Insufficient data."

"Just in your database, or insufficient data, period?"

"My database contains all information available in our time of origin."

Very odd. But I'd just have to live with that oddity. I wasn't surprised no one had yet made jumps into downtime to investigate whatever had brought about the Spanish Influenza's multiple simultaneous deadly assaults. Jumping into plague zones isn't the smartest thing to do. In the case of the Spanish Influenza, for which I confirmed with Jeannie a specific vaccine had never been developed, it could be suicidal. And I was only here and now to collect extinct seeds, not to try to stick my nose into dangerous and unresolved medical mysteries.

But I'd only made half a block toward my next destination when I got diverted anyway.

"I'm detecting a nearby temporal field," Jeannie advised.

Another jumper here and now? There's not *that* much demand for extinct seeds. "Coming or going?"

"From the temporal jump field echo, it's an arrival."

I looked around, trying to remember what the street had looked like moments before and whether there was an extra person suddenly out there now. Instead, I saw a rapidly forming crowd peering down at someone or something on the ground across the street from me. I weighed the term "Spanish Influenza" and the risks of mixing with people against the chance that the crowd might be forming around a fellow temporal interventionist, perhaps one who'd been injured.

By the time I got there, though, the crowd was breaking up. A pale, skinny man was being helped to his feet by a stout character. Jeannie did a quick visual diagnosis. "Seizure disorder."

"The pale guy just had a seizure?"

"Correct."

"I guess that rules him out as the person who jumped in." I meant the comment to be sardonic, but Jeannie surprised me.

"He is carrying a jump mechanism. The fading field signature indicates it is a primitive design."

I took another look. The man was indeed skinny, with the look of someone who'd never gotten enough to eat. He was tall, though, like someone who ought to be very big and healthy if he wasn't starving. His skin seemed paler than a seizure could account for, and I

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wondered if he was anemic as well. His eyes blinked, watering heavily, and the man sneezed violently several times before he fished a handkerchief out of one pocket and held it over his mouth and nose.

"His clothes appear to be original to here and now," Jeannie added. "Their fabric has indications it has aged substantially since its manufacture."

The sick man in the old clothes smiled weakly at his helper, waving off further offers of assistance, and stumbled away, one hand carrying some sort of valise. If the jump mechanism was as primitive as Jeannie thought, it might be in there instead of being an implant. I saw the jumper pause after several steps and look around in the fashion of someone who was unfamiliar with their surroundings. But as soon as his eyes fell on the same hotel where I was staying he headed that way as if he knew the place on sight. More strangeness. "Any idea when he's from, Jeannie?"

"I cannot correlate the apparent age of the garments and his apparent ethnic mix with any specific uptime period which would account for his physical condition."

"Maybe he's from inside a closed loop." Somewhen created by an attempted temporal intervention, and then choked off by a countervailing intervention, so it had been but never been.

"A loop born of a late twentieth-century full-scale nuclear war might correlate to his appearance and the apparent age of his garments."

An ugly possibility, but that could certainly explain the man's physical ailments. "Why would someone from that kind of loop come here?"

"Insufficient data."

A refugee fleeing a horrible future and seeking what he thought was an idyllic rural past? That wasn't impossible, but if so I needed to see what he was up to. An amateur messing around in my history might create any number of inadvertent interventions with big consequences down the road. If he did intend some deliberate intervention, now was an important period, but he'd picked an odd here to do it. All the temporal interventionists I knew of in 1918 A.D. were working in Europe or in national capitals. I'd picked 1918 myself only because the year was so well mapped for temporal jumps. Like me, though, this guy had jumped into a here where nothing of great importance had ever happened.

Except the start of the Spanish Influenza. But that'd apparently already been underway for a while. "When were the first reports of the Spanish Influenza?"

"March, 1918 A.D."

"And he just got here. So he couldn't have brought that germ with him and introduced it by accident."

"Not unless he had an earlier or subsequent jump to the earlier date," Jeannie reminded me.

Oh, yeah. But that made very little sense. Why jump back or forward a few months in a small Kansas town in 1918? Even if jumps weren't extremely expensive, they also involve physical stress, and my unknown traveler obviously wasn't up to the stress of pleasure trips. Nor did wherever and whenever he came from seem wealthy enough to pony up money for jumps that frequent.

I sat down on a handy bench and thought about it, my eyes on the door to the hotel. I was still thinking when the jumper came out again, his handkerchief once again over his nose and mouth, and walked unsteadily down the street. The other hand still held the valise. I waited until he'd gone a good distance past me and then followed, ambling along as if I were talking a pleasure walk in the Kansas heat and wind and dust.

"He appears to be headed toward Fort Riley," Jeannie advised.

"Why is an obviously physically frail man heading for the place where a lot of sick people are located?"

"Insufficient data."

"Somehow I knew you'd say that."

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The swelling of Fort Riley's population due to the demands of the so-called Great War had resulted in a fairly steady stream of transit between Junction City and the not-too-distant main entrance to the Fort, which far from being a stereotypical wooden stockade turned out to actually be a pretty large expanse of northeast Kansas dotted with military facilities and housing.

The jumper didn't try to enter, instead mingling with those outside the gate. I wandered close enough to hear him asking about the epidemic. How many were sick? Had many died? Were people worried? Understandable questions, which attracted no special interest from the locals. Their replies were fairly reassuring, speaking of not as many sick as before, not too many dead, and a general feeling that the epidemic was winding down. After asking those same questions of numerous people, including soldiers heading on and off the Fort, and getting roughly the same answers from all of them, the jumper went back toward town. The whole process should've reassured me, except for the unmistakable depression the jumper radiated on the way back to Junction City. He didn't seem to regard the information he'd acquired as good news.

The trip had clearly worn out the jumper, who stumbled back to the hotel. I waited for a few minutes after he'd entered, then went in myself and cornered the desk clerk. "Did a tall, skinny, pale-looking fellow just come in?"

The clerk nodded. "You just missed him. Goin' to his room, I expect. Sickly fellow. I'd have thought he'd be better by now."

"You've seen him before?"

"Yes, sir. He stayed here a few months back."

"A few months?" I felt a chill that had nothing to do with the temperature.

"That's right. Um, lessee, that'd have been ..." The clerk frowned, checked his ledger, then nodded. "February. Yes, sir. Checked in February the 26th and checked out March 5th."

And the Spanish Influenza had first been noted around here in March. I faked a smile I didn't feel. "That's my friend, all right. What room did you say he was staying in?"

"I didn't." The clerk grinned at his own joke. "3B, sir."

"Thank you." Had the man jumped ahead a few months to avoid the disease he might've carried here? But if so, why had he seemed so morose after finding out at the Fort that the epidemic seemed to be under control? Depression over knowing he could've caused the deaths which had occurred already? I had too many questions to which Jeannie would only answer "insufficient data."

I knocked firmly on the door to room 3B, waited a long minute, then knocked again in a way that conveyed I'd keep knocking all day if I had to do so. I heard sounds on the other side of the door, then it opened and the jumper looked cautiously out at me. "Yes?"

"Hi." I shoved my way into the room, using some subtle unarmed fighting techniques that pushed my opponent off balance until I was inside. I shut the door and held it closed. "We need to talk."

The jumper staggered back and held up his hands as if to ward me off. Seeing the extremities for the first time close-up, I could easily spot the swollen joints and twisted digits that marked severe arthritis. Was there anything this guy *didn't* suffer from?

I stood still, spreading my own hands out at waist level, palms out. "I'm not here to hurt you."

"Then why are you here?" His voice was raspy and weak. He seemed to be having trouble breathing. Asthma, too?

"I'm collecting seeds," I informed him.

"What?"

"Really. But I'm not from here. Just like I know you're not. And I'm not from now. Just like I know you're not."

It took a few moments for my state-

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ments to sink in. The man's eyes grew bigger, then started watering heavily. He sneezed, staring at me. "You've been to the grain elevator?"

"Seed suppliers."

"Uhhhh." He staggered back again like I'd threatened him. "Wheat dust."

Of course. "You're allergic to wheat." That could explain the malnutrition and anemia. The jumper stopped backing up when he reached the window, where the ever-present breeze blowing in would keep any grain dust I'd picked up from reaching him. "Do you mind telling me your name?"

"Call me John Smith."

"Very funny."

"That's the only name you're going to get."

"Fine. Mr. Smith, I don't know exactly when you're from, but I have reason to believe you've brought a disease back to here and now." Smith's expression had closed down, revealing nothing. "At the Fort, Mr. Smith. I know you're aware of it." Smith nodded. "Why'd you make a jump from March to July? Did you think the epidemic would be over by then?" Smith didn't answer, didn't move. "Do they remember germ theory when you're from?"

His face finally shifted expression, twisting into some sort of disbelief at my question. "*We're not primitive.*"

"You've obviously suffered some . . . uh . . . problems."

Smith grinned widely, as if I'd said something funny. "You've noticed that?" he rasped in that feeble voice.

"*You need to go away. If you're the vector causing this epidemic you need to isolate yourself.* That's not that hard around here. Stay there, until you're sure you're not a carrier."

He nodded again. "Certainly."

Liar. I didn't need Jeannie's analysis of his breathing and other external signs to know that. The answer, the agreement, had come too easily. "Why are you here? I want the truth."

"I'm . . . seeking refuge."

Another lie, I was certain. "A man allergic to wheat seeking refuge in twentieth-century Kansas? A man with a lot of medical problems seeking refuge in a time when medicine was still very primitive?"

"I have my reasons."

"Share them with me. Please. Or else." I'd long ago learned that keeping threats vague allowed the recipients to imagine the worst thing they could envisage, which could easily be worse than anything I'd really do. But, if this deceitful idiot really was spreading what would become known as the Spanish Influenza, I had to bring him to his senses.

Smith took a step to one side, reaching out to grasp the handle of his valise. "Sorry," he whispered, just about the time I remembered that the valise probably contained his jump mechanism. I hadn't taken half a step toward him before Smith popped out of existence.

"He has jumped out of the temporal period," Jeannie announced.

"Really?" I tamped down my irritation. "Which way did he go?"

"Uptime."

"Can you estimate the length of the jump?"

"My calculations are very tentative, but based on the strength of the temporal pulse I would estimate the jump involved a chronological period of less than one month."

One month. This was July. Next month was August. When three different locations would simultaneously or almost simultaneously experience outbreaks of a *much more virulent strain of the Spanish Influenza.* I remembered Smith's unhappy reaction after he'd heard the epidemic appeared to be subsiding here and now. Maybe he hadn't been depressed for the reasons I thought he had been. "He's doing it on purpose. Whatever he introduced here in March isn't doing the trick, so he's going to set loose something a lot worse."

Jeannie managed to follow my logic trail without having it spelled out for

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her. "There is a significant probability that you are correct."

"Why would anyone do something like that?"

"Insufficient—"

"Yeah. I know." Smith didn't look like a mass murderer, but I'd personally seen people as diverse as Caligula, Genghis Khan, and Adolph Hitler. None of them had "looked" like mass murderers, either. I still don't know what a mass murderer looks like, and I've seen some of the worst. "Where were those three locations again? The ones where the much more virulent strains of Spanish Influenza will pop up in August?" Jeannie recited them and I thought over my options. Boston was (for this now) a big city, filled with humans who had the same general ethnic appearance as Smith. My chances of finding Smith there were damned close to zero. Same for the city of Brest, in France.

But Freetown was another story. A much smaller town, and Smith would be a Caucasian in an African country. A Caucasian who'd be particularly easy to track down given his appearance and ailments. All I could do was hope Freetown was his first planned stop. "Jeannie, is my bank balance good enough to afford a jump to Freetown?"

"No."

"Is my credit good enough—"

"No."

"Can I mortgage—"

"No."

"Are there—"

"No."

Jeannie didn't have to read my mind. We'd had this sort of conversation before, on other jumps, and her learning subroutines were well up to the task of figuring out this was another case of my wishing for more than I could afford. I sighed and pulled out the small device that would manufacture as much local currency as I needed. Too bad the now I came from could detect the counterfeit stuff in a heartbeat. "Can here-and-now transportation get me to Freetown, Sierra Leone within three weeks?"

"Possibly."

"Let's get going."

I bid adieu to the Kansas prairie, using plentiful amounts of local currency to bribe my way onto the next train east despite wartime travel restrictions. American east coast ports were full of ships, and a lot of those ships would be stopping at Sierra Leone. I'd wondered why it might be a good place to feed an epidemic, if that's what Smith was doing, but it was in fact a very good place, indeed. Or a very bad place from a different perspective. Freetown was, now, the primary re-coaling site for ships crossing the Atlantic Ocean as well as those en route to other parts of the world. Just about every ship stopped there. If Smith intended having those ships take on a nasty new variant of the Spanish Influenza, it'd spread worldwide as fast as now transportation could possibly manage it.

Not that those coal-fired ships were as swift as I would've liked. Even while thanking providence that I didn't have to worry about a wind-dependent sailing ship for this crossing of the Atlantic, I still had entirely too much time to think on my trip to Freetown. "Jeannie, how many people died in the Spanish Influenza epidemic?"

"Exact figures are not known."

"What's the estimate?"

"Twenty million dead is the low end. The high end is generally set at around forty million dead."

Twenty million. At least. "What's the now world population?"

"Of humans?"

"Yes." What else? Artificial intelligence, again.

"Approximately 1.8 billion."

I did some math in my head. One or two percent of the world's population dead in the course of less than a year. Amazing, in a very bad way. "You told me we don't have a vaccine for it. Why not?"

"The Spanish Influenza vanished after

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the epidemic. Attempts to analyze the disease from fragmentary samples in partially preserved victims were undertaken in the early twenty-first century, but were inconclusive."

"Jeannie, diseases don't just vanish. They may be driven to extinction by proper medical actions, like smallpox was, or go underground for a while like bubonic plague before they pop up again, but even I know diseases don't simply vanish without a trace and never resurface."

"The Spanish Influenza has never resurfaced."

Every new thing I learned about the disease made it a greater anomaly. "Is there anything else unusual about it?"

"Clarify?"

"Anything else that made the Spanish Influenza different from other outbreaks of influenza?"

"Yes. Influenza viruses normally posed the greatest mortality risk to humans who were very young or very old."

"The weakest, in other words."

"Correct. However, the vast majority of those killed by the Spanish Influenza were in the age range of fifteen to forty chronological years."

"Adults? Were they predisposed somehow?"

"Insufficient data. The only conclusions medical researchers have been able to affirm are that those who should've had the strongest immune systems were those who were most likely to be killed by the illness."

I leaned on the rail of the ship, looking out across bright blue waves capped by spurts of white foam. Clouds of sooty ash from the ship's smokestacks drifted slowly down into the water astern of us, disappearing without apparent trace. Little wonder now-humanity still believed the ocean was a limitless sink for pollution. "I guess in this case strong immune systems were a bad thi—"

Jeannie waited a moment. "Clarify?"

"Jeannie. Autoimmune diseases. Like that Smith guy has. Those were caused by immune systems attacking their own bodies, right?"

"That is essentially correct."

"So, asthma and arthritis and wheat allergies, they're all signs of an, uh . . ."

"Overactive immune system."

"But the Spanish Influenza wasn't an autoimmune disease?"

"The Spanish Influenza was very definitely a type of influenza."

A type of influenza that seemed to have uncharacteristically targeted the strongest human immune systems. I had a lot of pieces, but none of them fit into a reasonable picture. I needed Smith. And the next time I had him cornered, I'd wrap my hands around his scrawny neck to keep him from jumping away from me again.

I prowled Freetown for a good week after arriving, spreading around more bribes and descriptions of "John Smith," with promises of bigger payoffs for anyone who found him for me. Eventually, somebody did.

I waited until I knew he was in the room he'd taken at a transients' boarding house, then broke the door open and had one hand on his neck before he could move. "Hi. We have a conversation we need to finish."

Smith stole a glance toward the valise he had no chance of reaching, then glared at me, his eyes very wide in that very pale face. "You have no idea what's at stake."

"So tell me."

"What if I don't?"

"Maybe I'll break your neck, then take that bag of yours and drop it into the hottest boiler I can find so that anything inside it is totally incinerated." Smith's eyes widened even more and he trembled. Then his eyes swung all the way to one side and stuck there, while his body went limp except for his hands, which twitched over and over again.

"He is suffering a seizure," Jeannie advised me.

"I figured that out." I kept my hand on

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his neck. "Could he be faking?"

"It cannot be ruled out, but a seizure disorder such as he apparently suffers from can result in seizures being triggered by stress."

Stress like someone breaking into his room and threatening to break his neck. I sighed, made sure Smith's seizure didn't seem life threatening, transferred my grip to his wrist, and waited.

Three minutes later, Smith's eyes regained their focus. He stared at me for a long moment before recognition entered them. "Happy?" he whispered.

"Knock it off. I have no sympathy for you."

"Really?" He held up his free hand, the arthritic joints almost painful to even look at. "Do you see this? I can barely grasp my bag with it. Even then it hurts. It always hurts. Do you know what's it like to always hurt?" Smith's weak voice broke on the last word, as if he'd run out of air.

I kept my eyes away from the twisted ruin of Smith's hand. "No. How does that justify what I think you're doing?"

"You don't understand."

"Right. I don't. So why don't you and I take a paired-jump to my uptime where some people in authority can listen to you explain it all in detail?"

His eyes showed fear. "You can't."

"Yes, I can. And I'm about to."

"No!" Smith tried to twist out of my grip, then started gasping for breath.

"Asthma attack," Jeannie informed me. Smith's free hand fumbled desperately in one pocket. I watched, trying to remain dispassionate, as he tried to bring out a small device and dropped it on the bed. "Aerosol medication delivery device," Jeannie added.

I picked up the thing and offered it to Smith. He grasped it as carefully as his warped hand and labored breathing allowed, then sprayed something from it into his mouth. A few minutes after this labor his breathing was back to normal. For him. He stared at me, then nodded his chin to indicate the device. "Thank you."

"I assume I may've just saved your life."

"Yes. You may have."

"Why did I do that?" I asked even though I knew the answer; because I still wasn't certain of Smith's guilt, and even if I were, I didn't have it in me to watch someone die if I could prevent it.

But Smith looked away as if embarrassed. "That's a reasonable question, isn't it? You've guessed what I'm doing."

"Am I right?"

I couldn't look directly into his eyes, but Smith's face twisted with some emotion I couldn't read. "Yes."

"You're deliberately spreading what will be known as the Spanish Influenza. You dropped off the first batch in Kansas in March, then checked on its progress in June and figured out it wasn't lethal enough. So you're here and now to spread a much more lethal variant."

"That's right."

"I assume you're doing this for a reason."

He kept his face averted from me. "I need to change the future."

I couldn't help sighing. "A temporal intervention. That's what the Spanish Influenza is/was?"

"Of course." His raspy voice had sunk to a whisper, but I could still hear it clearly enough. "What else?"

"I'd wondered what natural disease would appear in three places at the same time, and then disappear without a trace."

"Yes. It'll disappear. We designed it that way. A genetically engineered suicide instruction. What you call the Spanish Influenza virus will die out after one year."

"Gee, that's really humanitarian of you."

My sarcasm got a reaction. Smith swung his head back and glared at me. "What the hell do you know about it? Humanitarian? You smug bastard! Have you ever heard of the autoimmune

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plagues?" I shook my head slowly and Smith trembled. "It works. You're from . . . when?"

"None of your business."

"After the twentieth century? After the twenty-first?"

I decided to tell him that much. "Yes."

"God help me." Smith let his gaze wander, staring straight up as if he could see through the roof. "We stopped them."

"Stopped *what*?"

"The autoimmune plagues." Smith held up his hand again, his eyes still staring up toward the heavens he couldn't see. "We didn't know what was happening. Sudden surges in the incidence of diseases and ailments. One hundred, two hundred, three hundred percent increases annually. Asthma. Hypothyroidism. Hyperthyroidism. Arthritis. Many other things. We didn't understand, for the longest time. Too long. Finally, we knew. Evolution and science had failed us. Given us better and better immune systems as we survived the assaults of everything Earth could throw at us, while we developed vaccines to keep many natural ailments away from our ever-stronger, ever more vigilant immune systems." He fell silent, breathing heavily.

"And?" I prompted.

"And? You fool. Don't you see? Our immune systems were so strong, so vigilant. They didn't have enough to do. They attacked *us*. More and more. Our digestive systems, our nervous systems, our joints, our cardiovascular systems. Everything. And we didn't realize what was happening until literally millions were afflicted and more coming down by the day."

"Millions?" I prompted.

"At first. By now it's billions. Crippled and dying by the very immune systems which are supposed to protect them." He looked back at me at last, his eyes wild. "Billions. Society is collapsing. Worldwide. Too many people sick in the most fundamental ways with no means of correcting their conditions. They just linger on, dying very slowly, needing more and more medical care. The only 'cure' we have is to suppress the immune system with some crude methods available to us. Do you know what happens when you do that? The autoimmune diseases go into remission, but then you die from any number of 'normal' illnesses. We can't win." He gestured down his own body. "The medications I have to take to keep my immune system from causing me further agony themselves make me prone to seizures. How's that for a bargain with the devil?"

I tried to read truth or falsehood in his eyes and couldn't manage either. I asked Jeannie, instead, then relayed her information. "That sort of thing started to happen. In the very-late twentieth and early twenty-first centuries. We developed treatments."

"We didn't! Don't you understand? *We bought you time*."

"Bought us. . . ?" The things I knew suddenly clicked into place. An influenza that killed those with the strongest immune systems. Killed them by the tens of millions. Leaving those with weaker immune systems still alive to pass that on to future generations. "Eugenics."

"No! This isn't about making humanity 'better,' whatever the hell that means. It's about culling enough of the strongest immune systems from the human gene pool *now* in order to put off the onset of the autoimmune plagues for another one or two generations. Long enough for medical science to develop the means to diagnose and treat the disorders before they overwhelm the human race."

I turned inward to Jeannie again. "Is what he's saying plausible?"

"The scenario outlined does not fall outside the realm of possible historical outcomes."

"Is it likely?"

"Insufficient data."

Smith shuddered, and I looked down to see my hand gripping his arm so tightly that even on his thin frame the flesh was coming up in ridges between my

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fingers. "You want to be free to kill tens of millions of people."

His gaze was defiant, now. "Yes. For the sake of billions of people in the future."

"I've heard that argument before."

"I'm sure you have."

"Do you think this'll save you? Produce an alternate version of you who's healthy?"

"I don't know. I don't care. Not about me." His eyes flicked away from mine, but I saw tears welling there. "The kids." He was whispering again. "Dear God. The kids. They don't even know. Don't understand what's twisting and crippling and killing them. They live and die in pain and we can't even explain to them what's happening. We can't help them."

It's not supposed to be like this. When you meet someone bent on mass murder, they're supposed to foam at the mouth and talk like a fanatic and their eyes are supposed to be filled with righteous certainty. And I was supposed to be absolutely certain that stopping those deaths was the right thing to do. Instead, I felt a sick uncertainty inside, and translated it into anger. "You're just killing a few tens of millions of people for the kids, huh? You don't plan on being better off yourself? Do you realize the odds that introducing this plague here and now could just cancel you out? Eliminate your ancestors so you never exist outside of the closed loop you've created? You'd never see that great new world you say you want to make."

Smith's mouth worked for a moment before he could answer, but I saw a strange glint of what I thought must be eagerness in his eyes. "This is more important than me."

I closed my eyes to shut out the sight of his. There was only one thing I could be certain of. In my history, Smith's mission had unquestionably succeeded in its immediate goal. The Spanish Influenza had killed its millions upon millions. If I stopped him, I'd be making a major temporal intervention with results I couldn't predict on the future from that point forward. Would it be the hell Smith was describing? Or better? Or worse? There simply wasn't any way for me to know. "How can I let you go out of here and kill tens of millions of people?" I finally said softly.

Smith kept his eyes fixed on mine. "For the sake of billions yet to come."

"That kind of math is an abomination."

"It's also true. Dammit, do you think we *wanted* to do this?"

And somehow I knew then that Smith wasn't lying. He might be delusional or crazy, but he believed what he was saying. Which left it up to me. Change my future, or let Smith kill on a scale unmatched in human history. Save tens of millions, maybe, and if Smith was to be believed, condemn billions to awful fates. Take a chance that whatever my own intervention caused here would produce a future no worse than the one I knew of from this point forward. But that was impossible to know. Even aside from the group impact of so many humans living who'd died in my history, any one of those individual Spanish Influenza victims could've been another Hitler or another Einstein or another Martin Luther or another Julius Caesar. I looked at Smith again, letting my eyes stray down his ruined body. What kind of society would send somebody in his physical condition on a mission it regarded as so important? Only a society at the end of its rope.

I didn't trust myself to speak. I just let my grip on Smith go and stepped back. Then I turned around and walked out. He might've called something after me. I couldn't be sure and didn't want to know.

Dawn found me staring across the anchorage of Freeport, thinking about the extra, unknown cargo those ships would be carrying soon. I looked down at my hands, didn't see any blood there, and wondered why. Twenty million. At least. For the future good of the human race.

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For the future I knew, for better or worse, though it easily could've turned out a lot worse. I knew that, and when push came to shove I couldn't risk a worse outcome in the future. Even though that future now felt forever tainted. Playing god isn't all it's cracked up to be. "Jeannie—"

"Yes?"

"It's nothing. I just finally figured something out." That flash of eagerness in Smith's eyes. He wasn't afraid of being cancelled out of the future he was creating. No, he *wanted* to be cancelled out of that future. Wanted to cease to exist, so that even an alternate version of him who had no idea what "he'd" done would suffer the ultimate penalty. I understood now. Because, unlike Smith, I'd have to live with the knowledge of what I'd done, or more correctly what I hadn't done, for the rest of my life. "Work up a jump home, Jeannie. Let's get out of here." Before Smith's influenza started its deadly march across the planet.

I hope the kids who would've been Smith's came out okay. ■

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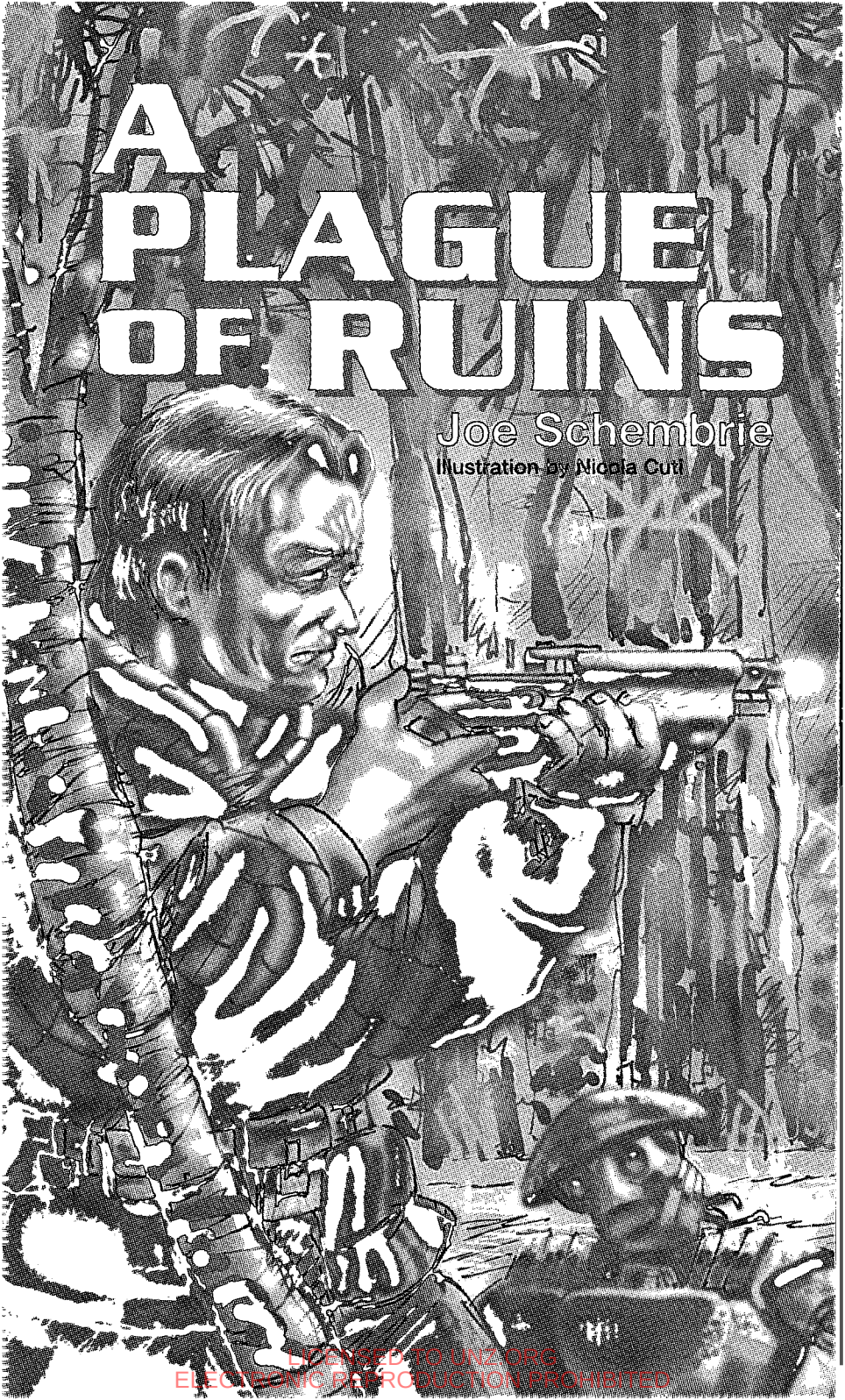

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With a single kick, the robot smashed the rotted door. It passed into the room, sweeping sensors and rifle barrel across the dark interior. Then it turned to the two humans in the passage.

"No physical threats, Doctor Martinez," the robot reported. "Environmental conditions within acceptable parameters. Radiation and biohazard detection negative."

John Martinez ducked his head under the broken crossbeam, stepping inside the room. He forced himself to breathe the dust, until his nostrils became used to it. Then he panned his flashlight over the rubble.

The room was ten meters by thirty. There were desks and computer terminals, broken and rusted and dust-caked. Tubular light sockets dangled from the partially caved roof. Paper, of course, had been eaten away centuries ago.

"Looks like another insurance office of the Lost Race of Nefal," he said—and sighed. "Won't Helen be pleased, coming two hundred light years to excavate *this*."

A hand touched his arm, and he stepped aside. A slender, caramel-complexioned woman in her mid-twenties slipped by. Andrea Ramakumari's flashlight spot danced upon the desktops and shattered floor tiles, coming to rest upon a pile of bones. She knelt, cradling a humanoid skull with fang scrapes along its cracked crown.

"Catwolves were here too," she said. "We haven't found a room yet that they didn't penetrate."

Reflected sunlight poured through an overhead vent shaft whose perimeter had been enlarged with the jagged outlines of swiping paws. Andrea picked several of the bones with tissue and packed them inside a pouch. John went to one of the desks and removed the corroded cover from the computer. His tongs snapped out the circuit cards, which went into his pouch.

Andrea shook her head. "I don't know what your fascination with those are, John. They aren't more advanced than what we had in the twentieth century."

"The Nefalians recorded practically all their digitized information on static RAM chips," he replied. "The day we find an intact Nefalian computer chip is the day we start to unlock the mystery of why their civilization fell."

"You don't accept the preliminary survey hypothesis, that it was war?"

"Maybe—but a war where the civilian population either starved to death or was eaten by wild animals, while the buildings remained intact?"

Something skittered among the desks. Andrea hastily arose. "If it's all the same, I'd like to continue this discussion back at the compound. It's late anyway."

"I suppose. Let's—" John's flashlight beam glared back, reflecting off a hand sized metal triangle that jutted from rubble adjacent to the doorway. He cleared away pebbles and dust, revealing a tube about ten centimeters wide. Further excavation unveiled three other triangles, projecting at right angles from the first.

"Aerodynamic control fins," John said, suddenly breathless.

"An anti-personnel missile," Andrea said.

John cleared more rubble. The tube was about a meter long, and terminated in a blunt nose. "The warhead didn't explode. We may finally learn what they were shooting."

He reached to pry out the nose, but her hand grabbed his. She pointed to the side label, orange-and-yellow with daggers and wide eyes. "That looks like a hazard-warning symbol."

"Andrea, this is so old . . . ." Seeing her gaze, he sighed. "You're right. We'll go slow and careful." He read the number off the robot's chest. "Robot

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Twelve, stay here."

"Yes, Doctor Martinez," the robot replied, in a voice programmed to sound cheerful.

They climbed the steps from the basement to the weed-grown streets of the ancient and dead city as the bloated orange primary sun was descending over the surrounding forest. John found the robot remote control unit in their equipment stockpile, and instructed Robot Seven to join Twelve in the basement.

While he waited, a stubby-winged bird glided from the forest into the city center. It flew past the naked girders of the crumbled towers, finally alighting on a second story perch.

"They're nesting in the city," John observed.

"The birds," Andrea replied, "have learned that catwolves can't climb girders."

"Catwolves raid bird nests?"

"They prefer humanoids, but they'll eat bird eggs. They're very adaptable, very resourceful. That's why they survive in such great numbers."

"Doctor Martinez," Robot Twelve intoned from the remote control transceiver. "We are ready."

John attended the screen, verbally directing the robots to delicately lift the missile, wrap it with plastic, and seal it in a box. Under his command, they tromped up the stairs. Soon they appeared at the top of the stairwell on the other side of the street, carrying the missile like they were pallbearers and it was a dwarf's coffin.

"Set it down," John said. "Commence sterilization."

Robot Fifteen approached the other two robots, aimed the sterilizer hose, and blasted them with steaming, acrid foam. The box received several washings as well.

"That's enough," John said. He turned to Andrea. "Satisfied?"

Andrea was staring at the box. "I still don't feel comfortable about taking it back to the compound. I—"

"What's *this*?"

A lithe, middle-aged woman, supple from rejuvenation treatments, whirled around the corner with a train of robots carrying boxes of excavated articles. She swiftly outpaced her companions and joined the other humans.

"Well?" Nefal Archeological Mission Team Leader Helen Tollers asked. "I'm assuming it's special if you had to foam it. So what is it?"

You should know, John thought, *since you'll take credit on the mission report.*

"A missile," he replied. "Warhead intact."

"Intact? Marvelous! We can find out what they were shooting!"

"Those were my words, too."

Helen pressed her radiophone to her ear. "Come and get us, Chuck . . . thanks." She lowered the phone and noticed the expression on their faces. "Something wrong?"

"We're thinking it shouldn't be taken back to the compound," John replied. "We can erect a remote analysis site right here."

"*'And just as the lid was removed, the mummy's hand lunged out and strangled the archeologist!'* Come on, John, that warhead's older than King Tut, and just as inert."

"Poison gas," Andrea said. "Poison gas wouldn't degrade over time."

"No, but pressurized poison gas would have diffusion-leaked by now." Helen's tone had a bite, and she was half-scowling. "We're not going to take unnecessary precautions that take up too much time and effort. The supply ship is coming next month and I'm not going home empty-handed. Our mission is to investigate this planet's civilization, and as there are only four humans on this entire planet, we all have full schedules with no time to waste. Are we clear?"

Before more could be said, they

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heard a deep chopping noise, and turned south toward the source. A helicopter streaked over the forest canopy, wove through the canyons of skeletal skyscrapers, and dropped onto the intersection the robots had cleared.

"If there's a safety precaution I need to address," Helen said, "it's how fast Chuck flies."

They loaded the artifact boxes into the rear storage bins of the helicopter. The robots took position on the skids, while the humans climbed inside the compartment. Interstellar Survey Service Lieutenant Chuck Clifton, his service-issue coveralls spotless, betrayed no emotion as their grime-encrusted work clothes left a trail of dust down the aisle and on the seats he normally kept fanatically clean.

"I was beginning to worry about you guys," Chuck said as he lifted off and veered southward. "Primary is setting and you weren't calling."

"We were preoccupied," Helen replied. "Some exciting finds today. Today was the kind of day that makes all the years and parsecs worth it."

The helicopter skimmed over trees at a level low enough that John felt he could scrape his knuckles along the branches. The ride was smooth, however, in the still air that came when the primary sun and red dwarf occupied opposite ends of the sky. For a moment, John's arm had two shadows. Then the primary sun sank out of sight, leaving the secondary to bathe the landscape in a light brighter than a terrestrial full moon.

Chuck nodded to the savanna to the west. "Mind if we take a detour? I want to show you all something."

Helen agreed, and the helicopter headed toward the savanna. Soon after passing over the brushland, Chuck hovered and turned on the searchlight. Creatures like antelopes with checkerboard fur lay sprawled and motionless upon the ground. Their eyes were glassy and their bellies had been shredded into red ribbons. Chuck twisted the spotlight over the surroundings, revealing the mangled corpses of dozens more.

"The handiwork of catwolves," Andrea said in a monotone. "There must be a pack nearby."

"Can we please have an end to discussion about catwolves?" Helen asked. "And Andrea, I think you should have christened them 'wolf cats.' They seem more cat than wolf to me, a lot like oversized mountain lions."

Andrea slumped in her seat. John kept silent, but frowned.

Chuck steered the helicopter southward again. The forests rolled below like the swellings of a green ocean. As dusk faded, a bluff of sandstone rose ahead. It was encircled by automatic gun emplacements, a four-meter barbed fence, and marching armed robots. On top, a cluster of a dozen tents huddled beneath lamps on high poles. The helicopter landed on the helipad alongside the tents, its rotors promptly flexing to a halt.

Helen jumped out first. "John, you'll inform me when you have the analyzer ready. I'm interested to see what's inside that shell."

"It won't be tonight," John said. "There's not enough time to make adequate preparations."

Their eyes locked across the pad. Finally, Helen said, "All right. In the morning. You'll let me know when you're ready."

Helen left, leading her box-laden robots to the storage tents. Andrea trudged off toward her personal tent. John supervised the remaining robots while they unloaded the missile-bearing box from the helicopter. Then he noticed that Chuck was still there, leaning against the helicopter with his arms folded.

"What was that about?" Chuck asked.

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"What's what about?" John fired back.

"That little exchange between you and Helen. And I noticed how she jumped on Andrea. Something happen back there in the city?"

"Yeah. That thing." John nodded to the box held by the pair of robots. "It's an unexploded weapon."

"Uhhhh . . . okay. But since it's a few thousand years old, it won't explode on *us*, right?"

"That's Helen's theory."

". . . I see. So you're wondering if you should mess with it. In other words, do you follow orders?"

"Yeah."

"Well, according to *my* bosses, following orders is the best policy."

The next morning, after fitful dreams, John awoke in his personal tent to the chirping of his radiophone. He rolled over on the cot, grabbed the phone on the third trill. "Hello?"

"John," said Helen. "Didn't you want to get an early start on the analysis of that warhead?"

His irritation at the pointedness in her voice made him pause before saying, "Uh, yes."

He sat up and regarded the alarm clock, strategically placed on the dresser so that he'd have to get out of bed to turn it off. The digital readout was blank.

"My clock isn't working," he said. "The first time in a year that I set it—"

The curtness in her voice declared she wasn't buying it: "Well, you are planning to do the analysis this morning, correct?"

He swung his feet onto the floor mat, where the light filtering through the window screen was making a warm square. He observed the angle of the primary sun, then consulted the planetary-rotation-adjusted clock display on his computer pad. *That* late?

"Give me five minutes to dress, Helen—"

"No, no, John. Take your time. I'm involved in a project of my own right now. Call when you're ready."

She disconnected abruptly, but three months of close association had made him used to that. Taking a few deep breaths of air, richer in oxygen than Earth's, helped clear his mind. He wrapped himself in his robe, grabbed soap and towel, and strode the few steps to the shower tent.

He was halfway through the rinse cycle when the water went cold. The shower readout still registered his temperature setting, but evidently no hot water was getting to the unit, because he went to manual and twisted the valve all the way to Hot and the water still had a chill edge.

"Not my morning," he mumbled.

He had stopped shivering by the time he dressed and entered the mess tent. Robot Seven was at the grill.

"Good morning, Seven," John said. "Your galaxy-famous reconstituted fried eggs, please."

"I'm sorry, Doctor Martinez," the robot replied. "I did not understand what you said. Please repeat."

John rubbed his tongue against the inside of his mouth, wondering if there was still some sleep-cotton left to garble his speech. With deliberation, he said: "Two fried eggs, please."

"Yes, Doctor Martinez."

While the grill sizzled, John sipped lukewarm, dilute coffee and turned to the open front of the tent. A breeze ruffled the tall grass as insects hopped unexpectedly high parabolas in the low planetary gravity. Nearby, Andrea was strolling beneath the popcorn clouds, gazing at the silver skeletons of the city's central triad of hundred-story towers, twelve kilometers northward.

"Andrea!" He waved.

She joined him at the bench. "So you're finally up. Helen was pacing in circles."

"Well, I didn't sleep in on purpose.

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Not that she believes me."

Andrea poured herself a cup of coffee, sipped, scrunched her lips, and set the cup down. "She's something else. I wonder if I'll be like that, after I've been out in the field twenty years."

"Well, not to take her side, but it's always a dice roll with extraterrestrial archeology assignments. She's impatient to make her major discovery, that's all."

"The whole Survey Service is impatient. It really bothers me. Back on Earth, archeologists are excavating the Palace of Knossos with shovels the size of spoons. Out here we're virtually bulldozing ancient ruins, because we're in such a hurry to find 'major discoveries' to justify the Survey Service's budget."

"Sometimes I do wonder if we're less archeologists than conquistadors."

Robot Seven laid out the dish. John carved off a slice of egg and stuffed it in his mouth. He frowned, his chewing slowed, and he forced a swallow with a grimace.

Andrea watched and smiled. "The grease didn't agree with me this morning, either."

"I'm not hungry anyway." He clanked down the fork. "Let's get started."

Half an hour later, they were sitting inside the analyzer tent, watching the robots walk a hundred meters from the tent cluster and place the box on the grass. The robots erected cameras onto tripods, strung control and power cables, and inserted the box into an airtight plastic bubble.

"A compromise solution," said Chuck, who was supervising the robots remotely. "We brought the warhead inside the compound, but unless it's a thermonuclear device, we're at a safe distance."

"I think Helen will still be disappointed that we're not risking ourselves as experimental guinea pigs," Andrea replied.

John didn't answer. Seated at another bench, he was taking advantage of the spare moments to conduct an analysis of his own. He opened the pouch that he had brought from the city the previous evening, and laid out the computer chips that he had collected. With tongs he grabbed what assumptions about parallel evolution in computer architecture told him was a memory chip, and placed it in a small tray. He inserted the tray into the analyzer.

He took the joystick control and watched the magnified display as he guided the probe needle up to the chip's casing. A push of the button atop the stick, and the probe drilled through.

Immediately, a trickle of dust feathered out of the hole.

"No," he said. "No, no, *no!*"

"More dust, John?" It was Helen, pushing open the tent flap. "*'Dust to dust, dust thou art and to dust thou shalt return.'*"

"Something like that," he replied, keeping annoyance out of his voice.

"Well, the chips are very old, and you can't expect them to maintain a highly sophisticated microscopic structure forever."

"Humans haven't been out among the stars for long," said John, "but we've already encountered several cases of extraterrestrial computer chips older than Nefal's. And yeah, you see crystalline disassociation. But nothing as universal as this!" He slapped the analyzer off. "We're never going to find out anything, not even the planet's real name!"

Chuck broke off from the robot remote. "What do you mean? I thought Nefal was its real name."

"'Nefal' is the name assigned to it by the captain of the ship that conducted the preliminary survey from orbit," Andrea replied, quietly. "It's Hebrew and means, 'To Fall.'"

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"Because their whole planetary civilization fell."

"Yes. Even from orbit, it was plain that here was a civilization that collapsed into extinction almost overnight. When I first heard about it in graduate school, I thought it was the greatest mystery in extraterrestrial archeology, which is why I signed up to come here as soon as I could."

"Despite an inordinate fear of large predators," Helen interjected.

Andrea's lips parted, but she didn't say anything.

The remote control unit behind Chuck squeaked. "Lieutenant Clifton," a robot said. "We are ready to commence insertion of the analyzer probe into the warhead."

Chuck's monitor showed a close-up of a robot holding the probe drill over the warhead. The other humans hunched closer.

"Very well," Chuck said, seeing nods from Helen and John. "Commence insertion."

A pause.

"I'm sorry, sir," the robot said. "I do not understand your request. Please be more specific."

A frown twitched on John's face. Robots normally didn't forget what they were just talking about ....

Chuck took a breath, and said: "Commence insertion ... of the analyzer probe ... into the warhead."

"Yes sir. Insertion commencing."

The robot pressed the drill to the warhead casing. A second window opened on Chuck's computer-screen, showing composition data indicative of doped silicon. As the sample from the warhead interior was inducted through the probe needle ever deeper into the analyzer microlab, another computer-monitor window opened to provide an electron microscope view of the sample itself. John leaned forward, eager to see the image.

It was soon in coming. The sample was jet black and writhed like a boiling cauldron with myriads of microscopic tendrils of vapor. But John, as a historian of computer technology, knew they weren't tendrils of vapor. They were manipulators—miniature arms with claws.

"*Nanobots*," he said in a cracking, hoarse whisper.

All the windows on the computer monitor went blank simultaneously.

Helen gathered them in her office-tent that afternoon. Out the north-facing window they could see, in the foreground beneath the horizon's bone-bleached spires, the containment with the missile and its warhead still enclosed. The assigned robots stood where they had been standing since communication had been lost hours before.

John was standing at the opposite wall of the tent, in front of a presentation screen which displayed a magnified view of the last image from the electron microscope, along with a schematic diagram that the computer had generated of a single nanobot in frontal and side poses.

Chuck gestured to the diagram. "So what you're saying, John, is that what looks like a big jaw with sharp teeth actually *is* a mouth—and it eats computer chips?"

"The design," John replied, clicking to an archived diagram on the next slide, "is very similar to a class of destructor nanobots studied by the US military around the turn of the century. That research, perhaps fortunately for the human race, never advanced beyond the theoretical stage."

"Nanotechnology hasn't yet fully delivered on its promise," said Helen. "We've discovered that mass-producing microscopic machinery isn't as easy as we thought."

"It's strange the Nefalians were able to do it," Andrea said. "Every other remnant of their computer technology that we've found is decades behind

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our own."

John nodded, turned back to the diagram, and continued: "If the ones here on Nefal behave like the ones we almost created on Earth, then when their warhead is opened, the nanobots are activated and become airborne particulates. They attach themselves to casings common to integrated circuit packages and start drilling. Once inside the IC casing, they energize themselves with the electrical potential across the circuitry. Then they proceed to chew up the circuitry. That's why we found Nefalian computer chips to be converted into dust. But for us, that's not the worst of it."

"How could anything be worse?" Chuck asked. "If they destroy the chip, they destroy the chip. How can things get worse than that?"

"They replicate."

The others shifted in their seats.

"They scavenge the computer chips for desired materials, then fabricate copies of themselves," John continued. "The replicants drill out of the casing, become airborne, and find other integrated circuits to infest."

"Infest," said Andrea. "Like a software virus. Only this is hardware."

"Yes."

"Then this thing could spread," Chuck said. "If it ever got back to Earth, it could wipe out human civilization."

"Fortunately, no. The factory-manufactured nanobots are optimal, but copying errors accumulate from one replication to the next, analogous to harmful genetic mutations in biological organisms. After a dozen generations or so, the nanobots cease to replicate, and by that time the old ones have broken down. Which is why we've found so many spent missile casings in the cities; one missile and one batch of nanobots wouldn't have been able to do the job of bringing down an entire planetary civilization."

"And even if you could build perfectly replicating destructor nanobots," Andrea said, "you wouldn't want to, because they would get out of control and spread back to your side."

"Apparently, they did get out of control," Chuck said. "Nefalian civilization did collapse."

"It was the shooting that got out of control," John replied. "Not the nanobots themselves."

"Okay, then—Earth is safe," Chuck said. "But how about us?"

"We're quarantining the warhead as of now," Helen replied. "No one is going near that thing. We're writing the test equipment and the robots off as contaminated too. And Chuck, we'll need the helicopter to drop an incendiary device on top of the contamination area."

John opened his mouth and hesitated. The others immediately looked straight into his face.

"It—it might be too late for that," John said.

"What do you mean?" Helen asked.

He nodded to the bowl at Helen's side. "How was your soup, Helen? I noticed you didn't take more than a few spoonfuls."

"It was served cold." She frowned. "What does my lunch have to do with this?"

"This morning, my alarm clock broke down. My digital alarm clock, with a computer chip in it. Then my shower water went cold. The compound's water system controller—which regulates hot water tank temperature, among other things—has a computer chip in it. Then I tried to have breakfast—but the robot cooked it wrong, just like your soup. And robots, of course, have brains of computer chips."

"So you think things are breaking down because the nanobots have gotten loose. John, the robots aren't the best cooks under any circumstances."

"They've never had trouble heating soup, Helen. And it's not just cooking.

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I'm sure by now all of you've said things to robots today, that you had to repeat or rephrase, because the robots either didn't understand your words or didn't catch your drift."

"But they haven't stopped working," Andrea said. "The ones directly exposed to the warhead have stopped, yes, but all the other robots are still functioning."

"Possibly because robots employ parallel-processing circuitry in their electronic brains. One neuronic pathway goes down, and the other parallel pathways pick up the processing load. But if the nanobots are affecting them, the robots will get slower and less coordinated and less perceptive and less mentally acute as the disease progresses."

"Alzheimer's for robots," Chuck said.

"And eventually," John continued, "something critical will go, and one by one they'll stop completely. And in the meantime, all our other electronics will be affected as well."

Helen sighed loudly and slapped her desk. "You're being paranoid, John! You're making a case out of trivial, unrelated incidents!"

"I agree the data is anecdotal, Helen, but I still think it should be investigated."

"Well, I don't see the value in wasting our—"

"There's one objective measure we can check right away," Chuck said. He tapped instructions on his computer pad and targeted the infrared sensor next to the presentation screen. "We'll just take a look at the processing efficiency stats for the compound's central computer."

The presentation screen flickered, and displayed the graph: a trendline that ran almost flat at 99 percent for the week and then—beginning mere hours ago—nose-dived toward the lower right corner.

"Less than 50 percent already," Andrea murmured. "It won't last the day."

"That can't be right," Helen said. "The central computer is programmed to notify me of even the slightest degradation in its performance!"

"Apparently," John replied, "it forgot."

"My God," said Chuck. "The electrical generator. The defense perimeter!"

"Catwolves," said Andrea.

John nodded vigorously. "Catwolves."

Under Chuck's direction, the robots dug a room-sized hole in the center of the mesa.

What little corrugated metal they had went around the enclosure, followed by spare segments of chain link fence and then the metal desks, lockers, and tables. Chuck personally welded the conglomeration into place, leaving peep-slots and a single entry into the makeshift bunker.

Toward late afternoon, as the primary sun sank in the west and their shadows grew longer and the shade of the surrounding jungle grew deeper, the robots started to stagger and stumble. Chuck eventually elbowed them aside and did all the construction. John came over to help shovel.

Chuck brandished a two-meter segmented tent pole. "We can ram these through the holes at the 'wolves, like spears. We'll need to crimp the ends, though, and sharpen them into points."

"What's wrong with the guns?" John asked.

The Survey Service lieutenant unholstered his pistol and tapped the display on the butt. "Computer-aided targeting, a palm-print scanning system to make sure only the assigned operator can use it, an electronic firing system. All this weapon's great features are about to become fatal flaws. Right now, I'd give anything for a non-computerized twentieth-century .45 automatic, or even a nineteenth-century Colt .44 revolver."

"And no smart bullets."

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"Yeah. The kind that are just gunpowder and lead, no electronics. *God!* Is there anything we don't put a microprocessor into these days? Car engines, toothbrushes, toilets—"

"Microprocessors in toilets are there for sanitation monitoring purposes. You wouldn't want to sit on a twentieth-century toilet."

"Yeah, but this afternoon our miracle-of-technology, modern-day toilets wouldn't even retract their sanitation shields, let alone flush, so I had to sit in the bushes. You know how many bugs crawl over this planet, John?"

"I'm guessing, a lot."

John's smile was returned with a grin and a laugh.

Andrea and Helen emerged from the supply tent, bearing boxes of food and water. The men stopped digging and wiped their brows.

"I was able to upload all the mission status to the log satellite before the generator went out and the comm link was lost," Helen said. "When the supply ship comes, they'll know what happened and can take the appropriate steps to rescue us."

"They'll know to leave us alone," Andrea said. "Because we're contaminated."

"They won't abandon us," John said. "Right, Chuck?"

Chuck, no longer grinning, turned as if he didn't hear, and went back to digging. John took a deep breath and joined him.

"We need to get the medical supplies too," Helen said. "The cumulative toxins from the atmosphere will kill us if we don't receive our weekly counteragent injections."

"How are we going to inject ourselves if the hypodermics aren't working?" Andrea asked.

"We have some old-style, non-electronic syringes—just needles and hand-operated plungers." Helen winced. "It's not going to be pleasant, but it'll work."

John suddenly stopped digging. He climbed out of the hole and stepped back, wearing a deep frown.

"I'm not sure *this* is going to work," he said.

"What do you mean?" Helen asked.

"Andrea and I must have come across dozens of rooms in the city that were as well-fortified as this, and the catwolves always broke through."

"This is where we make our stand. We have no choice."

"Maybe we do. I was thinking, in the city I saw—"

A gunshot and then another cracked the air.

John dropped his shovel—in hindsight, his sole weapon—and raced toward the edge of the mesa, to where the noise had come. He unbarricaded the fence gate, clambered down the steep stairway, and—suddenly sobering to the danger—crept forward to the edge of the clearing.

Robot Eighteen stood a few meters inside the forest shade, holding a smoking rifle, scanning a blood-splattered carcass sprawled before its feet.

The creature had the ears and snout of a canine, the tail and claws of a feline. It had the fur of a timber wolf, colored the sandy-yellow of a mountain lion. It was three meters long and had fist-sized yellow eyes and fangs longer than adult human fingers. John shivered; the forest seemed frigid after laboring in the sun.

The robot revolved its head, turning its black-button eyes to the human.

"Sir," it said. "The perimeter defenses are malfunctioning. It is not safe for you to be here. Please return immediately to the compound."

John felt the shadows loom in, and said, "Right."

He walked away, and re-emerged into the clearing's bright sunlight. At the base of the stairs, he met Chuck—whose pistol was drawn.

"Trouble?" Chuck asked.

Both of them abruptly turned to the

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forest. The robot was speaking again—to no one.

"Sir," it said, its voice faint with distance. "The perimeter defenses are malfunctioning. It is not safe for you to be here. Please return immediately to the compound. Sir. The perimeter defenses are malfunctioning. It is not safe for you to be here. Pleeth redurmmm—"

Its silhouette toppled forward and crashed into the underbrush.

Beyond, something in the forest snarled—something with a large throat and bad attitude.

"You were saying something about how the bunker won't protect us," Chuck said. "Tell me about that."

The sinking primary sun touched the mountaintops to the west. The growing shadows merged. Standing in the helicopter door, John spared a moment to watch and think about the coming night.

"I haven't heard any more yowling," he said. "That's a good sign."

"Oh, they're still out there," Chuck said from inside the helicopter. "The electric fences and autoguns may have taught them not to get too close, but according to the patrol robots, they've never given up probing our defenses."

"They'll figure out the perimeter is down, sooner or later."

"Sooner *than* later, I'm guessing. At least we have another hour before nightfall. We should be gone before the majority starts waking from afternoon nap."

Chuck lugged a metal box, plugs and cables dragging, from the electronics bay and handed it over.

"What do I do with this?" John asked, taking the load. Even in half-Earth standard gravity, it was still an armful.

"Toss it, for all I care. I'm trying to cut down useless weight, is all."

Coming abruptly from nowhere, Helen trotted alongside the helipad and placed her arms on her waist.

"What are you two doing here?" she demanded. "We still need to move supplies from the compound into the bunker!"

"Helen, the bunker isn't going to work," John replied. "We need to get out of here."

"Where?"

"The mountains, we're thinking. The catwolves don't go there as much."

She watched Chuck yank out more equipment and shook her head. "You can't fly the 'copter without computers, Chuck."

Chuck backed out of the compartment and stood astride the doorway, looking down at her. "It'll be harder, yes, and I'll be guzzling fuel without the flight management system engaged, but I'd rather wrestle a joystick than a half-ton carnivore!"

"Very few catwolves mass five hundred kilos, Chuck."

"My point remains. Even the little ones can rip open the throat of one of those herd creatures on the savanna in about two seconds. I've seen it, Helen, and humans aren't going to fare much better because we aren't any stronger and we sure aren't faster."

"I won't let you do this. That's an order, given to you by the team leader of this mission."

"Civilian team leader. Technically, I'm independent of your authority, and I'm responsible for the security of this expedition."

"Well, I can order the others to stay. You'll go by yourself."

Andrea had come up to the helicopter, and had caught the tail end of the conversation. Helen whirled to glare at her. Andrea looked away. Helen looked at John. John stared back, blankly. She had no trouble reading either set of eyes.

"So you'd leave me here by myself." Helen folded her arms. "Well, I'm not going up in that untested deathtrap."

"It'll be tested," Chuck said. "I'll go

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up the first time alone. If she flies okay, I'll come back for the rest of you."

"Otherwise?" Andrea asked.

There was a moment of silence. John finally said, "We have to go somewhere else. If we don't, what awaits us here will be far worse than a helicopter crash."

Chuck didn't wait for Helen to think of a response. He moved to the front of the compartment, took the pilot's seat, and flipped switches. As the engine growled, John stepped out of the doorway and joined the others at the edge of the helipad.

The rotors flexed as they whirled, elongating to provide more lift.

"John!" Andrea shouted over the whine. "The blades. They're dynamic composites, they practically *are* microprocessors—"

"He knows," John shouted back.

He watched with the others as the helicopter leaped off the helipad, arched toward the forest, and executed a lazy loop about the mesa.

Halfway around, the rotors abruptly shattered into clouds of fine dust.

The helicopter fell a hundred meters into the trees. A fireball erupted. They heard the boom a second or two later.

John stood numbed by the sight of the pillar of black smoke.

Helen glared at him, her whole body shaking.

"This is *your* fault!" she shouted, her face as red as the dwarf star now rising from the east. "*You* talked him into this! And that's what I'll say in my report!"

She stormed off toward the bunker. Andrea remained, watching him. It took a moment before he could even move his tongue.

"I—I'll get the medical supplies," he said. "You'd better get in the bunker."

"No," Andrea said. "I'll help you."

The mountains to the west, unreachably far away now, bit deep into the sinking primary sun.

John opened the cabinet above the counter in the medical tent and reached for a box of sterile pads. Andrea watched his hand tremble in the increasing gloom.

"It's not your fault," she said. "Chuck made the best decision given the information that we had."

And he may still turn out to be the luckiest, John thought.

"We still need to get out of here," she said. "Maybe we can find higher ground. I know there are other, steeper cliffs nearby; we've seen them from the helicopter. Perhaps there's one that's too steep for the catwolves, where we could set up a new base and wait for rescue. What do you think?"

"I don't know what to think," he mumbled. "Does it matter what I think?" The box of pads slipped from his fingers. He bent down, picked it up, and threw it in the carry bag. "Andrea, I'm the one who's responsible for all of this."

"What? What do you mean?"

He took a breath, and after a moment of gathering courage, he was able to look her in the eyes.

"There's no way the nanobots from the warhead containment spread to the rest of the compound," he said. "We had too many controls in place by then. The leakage must have occurred before that."

"When? How?"

"When I touched the missile. Some of the nanobots must have leaked out sometime during all those millennia before we came, and when I touched the missile, they got on me, and then I brought them back, and somehow they activated."

"How?"

"I don't know. Static electricity, motion, heat, pressure—whatever causes them to activate. The thing is, I should have been more careful. Lot that will help Chuck now."

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"You disposed of your gloves, John."

"Then maybe some of the nanobots were on the floor, and I stepped in them." He grabbed another box of pads. "The exact method doesn't matter. I must have personally brought the contamination back. That's the only explanation that makes sense, Andrea. I'm personally responsible for all of this."

He squeezed the box in his hands and it crumpled. He slammed it into the bag.

Then he choked the last words: "If we all die, it's my fault. All—all of this is my fault."

While John continued loading the bag, Andrea stared out the window. Then she tilted her head.

"John . . . a sprinkling of nanobots on your clothing couldn't have multiplied to the point where the whole compound is endangered."

His eyes narrowed. "How would you know that?"

"Well, I'm thinking about the missiles. They're conventional anti-personnel missiles and they have a range of only a few kilometers. They must have been used in street fighting to affect nothing larger than a city block. So if it takes an entire missile warhead to destroy a city block of Nefalian electronics, how could just a light dusting of nanobots on your clothing be enough to affect our entire compound?"

John opened his mouth to argue, but couldn't think of a rebuttal.

"You've said yourself, the nanobots replicate only so many times," Andrea continued. "If there were some on your clothing, they may have affected your alarm clock, the robots who went there, but not much more. They would have stopped replicating, long before they could have affected the whole compound."

"So what did affect the whole compound?"

"The nanobots from the missile warhead, I would guess. Despite what you think, our containment obviously failed. It wasn't designed to protect against machines that literally eat through materials on a microscopic level." Closing her eyes, she shook her head. "We should never have brought the missile back to the compound."

He blinked, and said, "I have responsibility for that decision."

"You're not team leader, John."

"I could have argued more strenuously."

"Helen had her mind made up. There was nothing you could have done, short of mutiny. She'll want to make you think you were responsible, but you can't—"

She shifted her eyes to the window.

"Did you hear something just now?" she asked. "A thump?"

"Another robot keeling over."

"No, this was heavier."

Her mouth and eyes were both open wide. John walked out of the tent.

The primary sun had set and the dwarf secondary bathed the tents and the mesa and the trees beyond with a pale, red light. In that light, stealing among the brush no more than twenty meters away from their tent, a shape no higher than John's waist but longer than he was tall slithered like a snake. Occasionally, a tail flicked above the stalks of grass, a writhing question mark . . . bobbing toward the pile of metal where Helen Tollers had imprisoned herself.

The last ten meters from the bunker, the catwolf broke out of the grass and streaked across open ground.

It leaped and snarled at the same time, and Helen turned and stared. She screamed for half a second, and the catwolf pounced upon the thin layer of chain link fence that was all that separated its fangs from the neck of its prey. The whole bunker shook and rattled, slumped and creaked. Helen fell backward into the hole, out of sight.

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The catwolf, wrapping its claws around the links in the fence, shook the barrier hard. The spot-welded joints creaked but held. The catwolf growled, dropped to the ground, and spied a fence post that had been stripped of its chain link. It picked up the bar in its teeth and wedged it into the gap between the fence and a metal cabinet forming part of the bunker wall.

Shoving with its paws against the lever, it started to pry the weld joint apart.

Nearby, a robot stood, arms clamped around its gun. It was oblivious.

The catwolf shoved against the bar harder, the weld joint cracked open. The catwolf dropped the bar and peeled away the fence links with its paws.

John's feet came to life. He ran to the robot. He grabbed the rifle out of its hands. He aimed as the catwolf twisted its head toward him and glared.

The gun barked out a hail of bullets. Only one was necessary. The catwolf, poised to leap, became speckled with dark, wet splotches, and slumped into a pile of motionless fur.

Andrea appeared at his side, puffing. "Did you see that? It used a tool! They're as intelligent as Earth-apes! At least!"

John helped Helen out of the bunker. The eyes that met his were devoid of anger, and her normally coifed hair was in chaotic strands. Her hand was limp and clammy.

She's as scared as you are, he told himself. But he found it hard to believe that anyone could be that frightened.

"Helen," he said softly. "We have to get out of here. We need to get someplace that's out of reach of the catwolves—and I think I know where that is."

She didn't argue as he glanced to the north, where the primary sun's rays, long vacated from the mesa, were almost done brushing the tips of the towers of the desiccated city.

Carefully, John unlooped the rifle strap from the robot, then pushed the robot's head gently with his palm. The robot teetered backwards and slammed onto its back, joining the other inert robot sprawled on the grass.

John checked the rifle's power setting. It was blank. He pulled the trigger. Nothing happened.

"Dead, like all the others," he said. He flung it over the fence, to join the computer pad and radiophone he'd disposed of hours earlier in similar fits of frustration.

The others didn't hear. Andrea was rummaging inside the storage tent, the sounds of her banging muffled by the rising twilight breeze. Helen tugged her jacket against her arms, transfixed by the faint rouge smudge on the horizon that was all that was left of the planet's primary day. John wasn't even listening to himself while he stared at the forest, where snarls were coming with growing frequency and volume.

"This is all so stupid!" Helen burst out. A line of moisture trickled down her cheek. "We'll never get out of the forest alive!"

"We'll get out of the forest," John said. "It's only a few kilometers to the city, and once we're there, we'll be safe."

But even he could tell from the tone that his voice lacked conviction.

Andrea emerged from the shed, her arms burgeoning with a pair of cases and a large plastic bag. She ran up to the others and set down her loads. She opened the bag, revealing a coiled optic-yellow rope with a grappling hook on the end.

"Excellent," John said, flexing the rope. "Exactly what we need!"

"Let's see if the survival kits have flare guns," Andrea said.

She unlatched one of the cases and procured the flashlight. The beam

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scanned over packets of freeze-dried foods, water bottles, medical supplies—and a holster. Unclipping the cover, Andrea removed not a flare gun, but a smart-bullet-shooting handgun. She touched the side stud and a tiny red screen lit with the numerals, 50.

"Still good," she said. "I'll use this one and give you the other—"

John blocked her hand from opening the other case. "Keep it in there. If we're contaminated with nanobots, they're already drilling into the gun you've got in your hands, Andrea. Maybe if we keep the other one in its case, it'll be protected from the nanobots a little longer."

"So let's go," Andrea said, rising. "Onto the city."

The two of them slung backpacks over their shoulders, and set out together. Helen remained standing next to the bunker. John went back and touched her arm. She glanced at them, then followed to the stairway down to the forest.

It was getting too dark to see colors, and shadows beneath the trees were merging into a common pool of blackness.

A path led from the clearing, into a thicket. They hacked with machetes, and came to a brook, whose babbling drowned out the wildlife. Their flashlight beams played against moss-covered trees as they crossed the water and ascended the gully to the other side. At the crest, John faced east. Slivers of faint reddish light peered through gaps in the foliage. Beneath them, he thought he saw yellow stars blinking in his beam.

No one spoke, yet somehow they moved as a unit. Relying on the reduced gravity of the other world, they leaped easily across fallen tree trunks that would have stymied terrestrial hikers. Nonetheless, after what seemed like hours, they grew exhausted.

After a seeming eternity, John realized they were lost. The dense forest blocked the towers and other landmarks, and he couldn't even get a general idea of the secondary sun's direction. He had no working watch to calculate distance traveled from walking rate. Their service-issue survival gear included a now-worthless interactive map—but no magnetic compass or physical map.

A child of the late twenty-first century, he had never been lost before. It was a unique dread.

As the night continued, the forest sounds—the birds, insects—which had been so universal during the day that they were ignored, now were glaringly missed. But they heard the snarls, the growls, the moans, the howling—the language of the predators.

"They're gathering," Andrea said. "Then they choose a leader, and then they follow the leader. And the leader goes where the scent is."

"I'm impressed with your expertise," John said. "You actually bothered to read the zoological team reports."

"Catwolves have spooked me from the start," she replied. "John, I don't think they evolved. They're too powerful for this environment, they're too smart, and they've got too many tricks of survival. I think they were genetically engineered."

He nodded. "I've been thinking along those lines. The nanobots, the catwolves—they complement each other too well. Like part of a plan to bring the planet to its knees."

"In other words, another star-faring species attacked the Nefalians. But if the attackers wanted to kill Nefalians, wouldn't nuclear bombs be more efficient?"

"Maybe killing wasn't the main objective. Say there was a galactic empire, and they needed slaves or military conscripts—and Nefal resisted conquest. So the enemy hits them with nanobots, disrupts their technol-

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ogy, and just walks in and sets the catwolves loose. And if the Nefalians didn't surrender then, they were faced with starvation, being hunted by wild animals, being torn to pieces, eaten alive—"

"Do we have to discuss archeological theories just now?" Helen broke in. "They can hear us, you know!"

"Our smell is what's giving us away," Andrea replied quietly.

"It's important to discuss what happened here," said John. "Earth could face the same situation someday." *And*, he thought, *I need to keep my mind busy.*

A catwolf uttered an undulating cry—which was joined by others, until the din surrounded them. Abruptly it halted. His heart pounding its rib cage, John forged ahead, forgetting how tired his arms were of hacking through the brush. The women, reduced to wraiths in the gloom, slipped through the trail he blazed.

Low gravity or not, John was relieved to reach the next hilltop. But then, out of the trees ahead, he saw a dark, shaggy shape move too swiftly for a terrestrial creature its size. He trained the flashlight beam.

The eyes flashed in the glare, and then the mouth opened, revealing gleaming teeth drenched with saliva in anticipation of a blood feast.

Andrea's hand rose, holding the gun from the survival kit. She pulled the trigger. The gun clicked. "*Damn!*" she muttered. The catwolf in front of them roared—and advanced with gathering speed, like a sprinter, a truck, an immense arrow of fur tipped with spike-long, needle-sharp fangs.

John grabbed the survival kit slung around Andrea's neck, snapped it open, lost his flashlight, fumbled blindly for the holster, unclipped the fastener, clutched the other gun, touched the safety stud, misfired a bullet into the branches, aimed at the catwolf, fired again, missing but illuminating the forest in a lightning flash so that they all saw not just a lone animal but a wall's worth of fangs and claws bearing upon their throats. He squeezed the gun with both hands and fired again, between the eyes of the lead creature.

The creature silently spilled over itself and tumbled not five meters away. Its cohorts, flanking in vee formation, broke off and dispersed into the forest, and except for their growls of exasperation, it was as if they were never there.

Helen and Andrea stared at John. It took a moment before they could even blink. Finally, Andrea let slip the contaminated weapon in her hand and said softly, "John, if you hadn't made us keep that gun protected in the kit, we'd be dead now—"

John wasn't listening. Having searched the forest for signs of motion, his eyes had come to a slender break in the trees—where, seeming to hover against the powdered dome of stars, there loomed the lacelike tracery of a Nefalian tower.

"Let's go!" John bellowed, when he'd caught his breath.

They reached the top of the last hill, and plunged into a meadow. John tried to gallop, but stickers caught his legs and tripped him. He arose, his hands bleeding from the thorns, and stumbled on.

Their boot soles hit flat ground—unnaturally flat ground, the remains of a road. They saw a man-high mound ahead, the fragment of a building, a wall enveloped by rubble and overgrown with the latest generation of millennia of vines. Beyond, less than a kilometer away, rose the tower they'd seen from the forest. It was one of the city's mid-size towers—twenty, perhaps thirty stories high.

Good enough, thought John.

His legs felt like rubber. He heard his breath like the outgassing of a geyser vent, and the others sounded like a

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chorus of the same. Helen flailed her arms and Andrea grabbed her before she splattered onto the broken pavement. John glimpsed a spark of yellow and shot at it. A night bird hooted in dismay.

The distance to the tower closed within half a kilometer—or was it still a kilometer? Perhaps it was a sixty-story tower. Then it would be a full kilometer. Perhaps he was dreaming, hallucinating the tower, the imaginary refuge of a mind unable to face inevitable death.

Helen halted and bent over, propping herself with hands on knees.

"Got to keep going!" John said.

"Only a little farther!" Andrea said.

"I can't . . . go on," Helen replied between whooping breaths. "I'm . . . too old . . . this is . . . too much—"

"Just a little farther," John said, grabbing her free arm. Together, he and Andrea pulled her along. But they weren't running now. It was agony just walking fast—staggering and wheezing, limping and gasping.

A catwolf wailed behind them. The wail was joined by another, then another, and then dozens of deep-throated voices all at once, crooning a song of terror and dispassionate cruelty. John glanced over his shoulder. Beneath the light of Nefal's red dwarf secondary sun and the single moon, a rippling flood of fur washed from the forest toward them.

He fired the gun into the pack. A galaxy of yellow eyes reflected the flash. The pack kept closing, encircling to cut off escape. John fired rapidly, indiscriminately, sweeping over the mob, cutting holes that clogged with new beasts, who only quickened the pace. John squeezed the trigger and blew out the center. The pack reeled back. Just as he thought—he'd gotten the leader, and now they had to regroup.

The red indicator read 24. Half gone already. At this rate they wouldn't need nanobots to seal their doom.

"Almost there!" Andrea shouted.

They crossed an intersection and saw the base of the ancient skyscraper, less than a block away. The bottom was blanketed by rubble. They ran to the base and started climbing. Yellow eyes surrounded, hesitated, then bobbed up the incline after their prey. John fired three times—and then the gun clicked uselessly.

"Keep going!" he shouted.

A catwolf separated from the pack and probed forward. John snatched a fragment of what looked like concrete, shrieked and threw it. The catwolf snarled and shrank back; the projectile, primitive as it was, was more intimidating to a catwolf than a loaded gun. But other catwolves closed in from the sides. The humans threw a hail of building shards. The catwolves snarled when hit, but drew closer.

Andrea reached the base of the skyscraper first. She dropped the rope coils, wrapped her fingers around the end, and threw the hook over the crossbeam girder. The hook looped and caught in the corner on the next level. She grasped the rope and looked back at them.

"*Climb!*" John shouted.

Andrea coiled her legs and sprang. Low gravity propelled her hands three meters high, and she grabbed the rope and pulled herself higher, hand over hand, fully ten meters to the horizontal girder that had once supported a building lobby's roof.

"Helen, *go!*" Martinez shouted, throwing projectiles at the catwolves. The creatures were losing fear, no longer confused by blinding flashlight beams. "*Go!*"

She was too dazed to move. John, clutching her around the waist, ran to the rope. He yanked their bodies upward with one hand, clamped the rope with his thighs, extended his hand, gripped, yanked again—but with Helen's weight it was too much—his

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strength was giving out.

"Can't save both of us!" she said. "Let me go!"

Overwhelmed with fatigue and fear, he almost did. But two hand-pulls later, Andrea's fingers reached theirs. Helen was pushed and pulled onto the girder.

John looked down. The catwolves closed in and covered the rubble beneath their feet, milling restlessly, gazing up and judging distances. One of them leaped. A claw swiped within centimeters of John's boot.

Andrea yanked his sleeve and with his own strength unencumbered, John shot himself upward and flopped atop the girder alongside a still-gasping Helen.

The pack swarmed beneath them. A few catwolves attempted to climb the vertical girders. But adamantine steel, unlike tree bark, was harder than whatever their claws were made of, and they always slipped. The humans watched, for the better part of an hour. Finally, the creatures gave up attempting to climb, and the pack slowly thinned, seeking better hunting opportunities elsewhere.

"Back in the days when there were stairs," John said, "they had no problem getting up into these buildings."

"Thank the stars for skyscraper ruins," said Andrea.

"Thank the birds," John replied. "I never would have realized it was safe up here if I hadn't seen that nest in the girders yesterday."

Andrea pondered the dispersing catwolves, her chin resting on her knee. "This seems too easy. An entire civilization perishes, yet we survive thanks to a rope."

"We knew what was coming," John replied. "We were able to prepare."

"This is only the first night," Helen said.

"John!" Andrea said. "Do you think they could build a ramp up here?"

"They could try," John replied. "But I think we're up too high and there's not enough debris to pile. But yeah, that's something else we should prepare for."

From his backpack John removed a bundle and unwrapped several meter-long hollow metal tent poles. He fitted the sockets, assembling two-meter poles. Helen and Andrea watched silently as John used the butt of his gun to pound one end of each extended pole into a crimped tip.

"Tomorrow," he said, as he distributed the spears, "we'll figure out how to sharpen them. And then we'll figure out how to make bows and arrows."

"Sure, John," Helen replied. "And after that we'll make a starship. One without microprocessors."

Andrea glared at Helen, her posture mimicking a catwolf about to pounce.

"Shut up!" Andrea snapped. "*Just shut up!* I'm so sick of you and your pretending-to-know-it-all attitude! Someone like you with obvious power-control issues should *never* have been put in charge of a mission! That'll be in *my* report!"

Helen was silent. Her only reaction was to glance away and lose all the color in her complexion, what color that could be seen in the dwarf star's glow.

Many weeks later, John was sitting on the same girder, watching a helicopter pass through the clear blue skies over the city. On the second circuit, someone in the vehicle must have spotted them, for it homed in on their building and landed in the street, upon the makeshift helipad that the archeologists had cleared in the days before their physical strength and confidence in rescue had begun to wane.

Out of the helicopter emerged two men, bedecked in immaculate Survey Service coveralls and carrying rifles wrapped in thick waddings of foil. Their eyes met John's. They approached.

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Taking his spear—both out of habit and because he needed something to lean on—John climbed down from the makeshift nest of branches that had been home for the past weeks, and hobbled among piles of rotting carcasses of dead catwolves whose skulls and spines had been crushed by rocks he and the others had hurled from their perch. He stopped several meters short of the newcomers and raised his palm.

"Stay back," John warned, his voice rasping through a parched throat. "We're infected with nano—"

"We know about that," said one of the approaching men, with the insignia of a lieutenant. "Now, is this all of you? Are you all right?"

John nodded, feeling pangs of stiffness in his jaw and neck. He followed the gaze of the men as they inspected the survivors. John's clothes were dirty and ripped, showing bruises and cuts sustained from forays into the forest, where too often hunter had been turned into prey. Andrea, brushing alongside him, was gaunt from days of subsisting on unpalatable local berries and game and stretched-out survival kit rations. Helen, pale and too weak to climb down from their redoubt, stared from above with sheenless, drooping eyes.

"We would have come sooner," the lieutenant said, "but we didn't think you were alive. We saw the helicopter wreckage and assumed—well, we're just glad you made it."

"So now," Andrea said weakly. "You'll take us back to your ship?"

"Well," said the lieutenant, "first we want to douse you with high-energy electromagnetic pulses, just to be on the safe side and electrically overload any nanobots that might be playing possum. It'll take a few hours to decontaminate—and then they want multiple full-body scans to verify. And then, I'm afraid we'll have to go through quarantine a few days." His eyes once again swept over their bent bodies and tattered clothes. "I'm sorry, our captain is a real stickler for precautions."

"Do ... do whatever has to be done," John replied, propping against his spear and squinting to keep from weeping. "So long as ... the water's the right temperature ... next time I take a shower."

He was hungry and thirsty and fatigued and sick in half a dozen ways, but it was the shock of abrupt release from accumulated stress that finally overwhelmed him. His vision clouded and his legs jellied. Andrea caught him as he started to fall. ■

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What Wise Men Seek

Mike Moscoe
Illustration by Rick McCollum

Any dialog needs
a first point of contact.
The trick is finding it. . . .

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Avbo Robido, Earth's latest ambassador to Kri'ron, turned back to us after hitting the red button that opened the shuttle's sealed door. "For God sake, gentlemen, don't trip over the gangway. You might as well slit your own throat if you fall flat on your face in front of a lobster."

So they'd told us. The Kri'ronkis made the Chinese Mandarins seem plain. They made the Klingons of twentieth century fiction look like friendly sea otters.

Like the Apostle Thomas, I would have to see it to believe it.

"No, no," he corrected himself, ducking his head back in the doorway. "We'll just pack you back into the shuttle and take you home." Understandable advice from a guy who intended to stay with us only for the afternoon and was riding the shuttle up this evening. As he said often while fluffing out his wrinkled white silk suit, "I've served my time in hell."

I stood in line after Father Superior. Behind me was Fr. Oyoni Garnni S.J. Following him was Fr. Sandy Sanchez S.J. Old Brother Paul occasionally limped; he was last so as not to slow us down. Father Superior had assigned us our places in line; like good Jesuits, we accepted his orders.

As soon as the door opened, the shuttle was invaded by the reek of salt flats and a sweltering heat that quickly defeated the craft's struggling air conditioner. We'd been warned that Kri'ron was hot. I grew up in Louisiana; I was prepared for hot. This humid heat had me sweating through my yellow cassock even before Father Superior led us out. *Maybe the ambassador hadn't been speaking figuratively about hell.*

I watched my step as I crossed the space from gently bobbing shuttle to stone-gray quay. A few careful side steps made way for my fellow Jesuits and I could stand in one place for a moment. One place that wasn't under acceleration. A month in space does strange things to your land legs and I needed mine back quickly. I kept my eyes down, not from any sense of humility but to keep from being blinded by the glare off the water. The sun, high overhead, pounded down on me, hardly dulled by the humid haze. A wisp of a bay breeze failed entirely to cool me and brought with it the smell of strange death and alien putrefaction. I struggled not to gag in front of the first Kri'ronki I'd seen other than in paintings.

The ones in sight showed why the race had earned the nickname lobsters, and why no one called them that to their faces. Two stood naked in the mud, holding lines that kept the bow of our shuttle hard up against the end of the pier. Two more held lines to the aft end. On the pier with us, four more easily manhandled our baggage and shipping containers from the shuttle's cargo hold. Any one of them outweighed three or four of us Jesuits, and none of us were small men. They balanced easily on the four rearmost of their eight limbs. Their two front appendages had fully developed hands with four fingers and two opposing thumbs and did very well at moving our baggage around. Their second pair back from the front seemed to alternately be either arms or legs, depending on what the containers needed to roust them ashore.

These stevedores were of higher status than the-line handlers in the mud. They wore rough shorts to cover the reproductive organs between their rear legs—and grew one long fingernail on each hand to gut-slicing length and sharpness. A low hum from small holes in their hard exoskeleton showed where ventilating air passed through, cooling the muscles beneath.

Truly, God's proposal staff had evolved another winning design.

Then two of the workers shoved a

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shipping container in my general direction and almost pushed me off the pier onto the muddy tidal flats.

"You'd best get out of their way," the ambassador said. "No Kri'ronki ever made way for an alien. And it wouldn't do to present yourself to customs all muddy and stinky. They'd slash your belly wide open for the insult."

Father Superior led us quickly along the uneven stone pier toward the low customs house at the end of the wharf just as another party started toward the shuttle from the landward end. Ten Kri'ronki bearers led off with large, coffinlike crates on their backs. Then my nose identified the crates as the source of the stink.

They were coffins.

"Oh, my word," said the ambassador, pausing in mid stride. Squinting against the light, I followed his gaze as he studied the customs house. Yes, eight—no, ten—long pikes were sunk into the sand in front of it. The distinctive heads of ten Firantan, twin tusks and all, gazed down through empty sockets at us. Ten heads to match the ten coffins coming toward us.

Trailing them was an unusual nine-sectioned Tiggarin. A lone Tiggarin section could hardly move on its own two legs. When two or three sections came together, they were better off, but hardly considered intelligent. Five or six segments seemed to form a natural symbiotic relationship for Tiggarins and could do anything a human could do, as well as easily switch out a section with others to pass along a complete block of experiences and ideas. For nine sections to develop the necessary coordination to work and think together would take years of dedicated devotion to a single cause. I'd never heard of more than a seven-section Tiggarin.

"Ti-ti-ga-to, what happened?" the ambassador asked, bowing low. So did Father Superior, so the rest of us did likewise.

"Damnedifiknow," came in English from the speaker on the leading segment's chest. "You know the Firantans, always taking shortcuts. And Fanta Fironno did have that twitch. If he was mixing syntax with context and twitched in the middle of one of his shallow bows. . . ? Well, we always said it was going to cost him." Four of the nine sections did a knee bend that made a wave of a shrug.

"But all ten?"

The first four segments of the Tiggarin assembly turned back to take in the ten heads. "All ten. And not a segment left to tell the tale. Total loss. We decided it was high time to take a vacation. What do you call it? Annual leave. The Giran and Zani bugged out ahead of us. I guess you Earth type are all that is left on planet. Good luck. I doubt it is very smart of you."

"I'm lifting with the shuttle," the ambassador said.

"Them also?" the other said, pointing at the Jesuit delegation with a leg.

"No. They are the representatives of the Spiritual League. They're here on their own business."

"Own business. Not our business?"

"Well, you know how that all goes. If they stumble on the right key, they will share it with us all."

"So you humans say. Me, I so wish you had segments to share."

"You tried breaking one of us up on first contact, remember?"

"You would remind us of that childish blunder, would you not." But the Tiggarin was concentrating on the Jesuits, waving the cilia that provided most of its sensory input at the delegation. "Are you one of those spiritual groups that places a high value on martyrdom? Because it certainly would be a great loss to die here for your Supreme Being and have it count for nothing."

"We appreciate your concern," Reverend Father said with a slight bow. "Is it true that you have no idea what

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went wrong and caused this?" He nodded at the heads before us.

"If we knew, do you think we would be leaving this planet to just you? No. No. Something went wrong. Maybe the moons were in some strange alignment. Maybe the wind was blowing from the wrong direction for him to bow that way. Who knows with these double-damned Kri'ronkis. You are welcome to them. Now, if you do not want to be knocked off the pier by your luggage, we had best all be moving along."

The ones pushing our shipping containers were almost up with us and showed no interest in pausing for us to finish our chat. Reverend Father led us along behind the ambassador toward the customs officials. To our right along the bay, Emil'on City stretched out, its low stone buildings of one and two stories hardly rising above what passed locally for trees; tall things with scaly trunks and wide green shoots coming off their tops like palm fronds, but not. Definitely, this was an alien world.

To my left Kri'ronkis worked in a patchwork of fields. Most looked like flooded rice patties, some with bright yellow plants that grew up to the farmers' knees. Others were covered with a low blue something that shimmered in the sun. Some paddies were dry and covered in purple or green; whether those were different crops or just different phases I could only guess. Dividing each paddy from the next were small levees with narrow dirt trails. This pattern was repeated as far as my eyes could see. Nowhere did I see a cart or any other kind of wheeled vehicle. If a Kri'ronki traveled, he walked. If something needed moving, he carried it.

And as best I could tell, all I saw were males at work. Males wearing those shorts over the rear of their exposed bones. Not a female in sight. Nowhere in space had humanity encountered a species that kept their females so protected. So out of sight. Uninvolved in daily business. Twentieth-century Arabia on steroids.

I turned my attention back to what lay before me as I reached the end of the pier. Now we passed between the heads of the Firantan and the insects buzzing at their feast.

Saying a good act of contrition—long form—I prepared myself for what was before me. Behind me came the muttered sounds of my fellow priests softly preparing themselves for death as well.

I considered saying a blessing for the departed Firantan, but held my peace. Of the other nine spacefaring races humanity had found in the last thirty years, most were at least willing to consider the possibility of a loving God. The Firantan not only rejected faith in principle but ridiculed any application of it in fact. We Jesuits represented the united believers of nine spacefaring races. Tens of billions were praying for our success. Not one was a Firantan.

The customhouse was open to any breeze on three sides. Its right side was a gray stone room with a crude padlock, which might hold back a picklock for half a minute. Along its left side ran a white stone table. Two customs officers waited for us beside the table. They wore the more formal blue-and-white pantaloons we'd been told to expect on Kri'ronkis of the higher classes. They also wore sleeveless shirts, in this case blue with yellow piping that proclaimed their status as officers of the government. The one with less piping talked to the ambassador in the language I had spent the last three years struggling to familiarize myself with.

"I am Customs Inspector Bonki. What do you call yourself?" The words were accompanied by the waving of four hands and various cilia around

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the face that might or might not have meaning. It was hard to get a full, in-depth analysis without a computer's help.

Carefully, I took a deep breath. What I'd taken as exaggeration by old hands during my training now was exposed as deadly understatement by the corruption and death above my head. I'd been chosen for this mission because I spoke dozens of Earth tongues. I was fluent in all four of the alien tongues used among the space faring races. I was prepared to dedicate the rest of my life to the greater glory of God here on Kri'ron, mastering the tones, inflections, sounds and body motions that went into communications here. I might just do that—if my life was not cut short like the Firantans up on those pikes.

I watched the ambassador wave one hand gently as grass blowing in the wind, fingers wide spread, as he presented his official credentials with the other. "I would hope to be familiar to you and your superior. I am Avbo Robido, Earth's ambassador to your Most Inimitable Lord. I am here to present to you several associates of mine who wish to live among you, learn from you and enjoy the wisdom that you may share with them about all the ways of right living."

Not a bad speech. Well executed with the proper clicks, rolled R's, and guttural sounds from deep in the throat, that our palates would never feel comfortable making. Finished, the ambassador stepped back—back a bit more than I thought he needed to—and let Father Superior and me step forward.

"I am Francisco Brindini of the Society of Jesus and Father Superior of this delegation," the tall, aquiline man in the yellow cassock beside me said with all the correct sounds, clicks and a most proper bow from the waist.

"Good, good," the senior agent said, coming forward and resting both hands, palms down, four killing-sharp fingernails clicking on the white polished stone top. "I have pictures of my sons and grandsons too. You show me yours, then I will show you mine."

Reverend Father dared not turn his back on the customs man—or his gut slicers. I turned to the ambassador. "Pictures of children," I whispered in English. "You know we are under a vow of celibacy."

The ambassador cringed, and backing up more. "But the Kri'ronkis are very proud of their reproductive success. No man can call himself a man of the true men until he has fathered a son."

"Why didn't you warn us?"

"We don't go around introducing ourselves as fathers," the ambassador said, very much in reverse.

I glanced back at the customs agent. Those killing blades were starting to do a rapid tattoo on the tabletop. I calculated Father Superior's life expectancy in seconds.

"May I provide this to you," Brother Paul said, stepping forward into range of those killing nails and pulling out his wallet.

Brother Paul had come to the Society late, after living a long life in the world and only upon burying his wife of fifty years. He was here to cook, wash dishes, do odd jobs, and anything else the Holy Spirit might desire. And like just about every proud grandfather I'd ever met, he had pictures of grinning grandchildren that he would produce at the slightest hint of interest.

The customs agent was certainly showing more than normal interest.

Paul stopped beside Father Superior and began laying out pictures on the stone tablet. Warned about the Kri'ronkis' strict rules against high tech, Paul had paper copies of his favorite pictures. Still, color photos were a notch or twelve above the black silhouettes that the agent produced.

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Somehow in the happy babbling, the exact parentage slipped a cog and Brother Paul with his poor grasp of the language made no effort to correct the senior customs agent when he started joking with Father Superior about how cute his latest grandkid looked naked on a bear rug.

When the time came, I introduced myself as merely Francis Xavier O'Mally, Society of Jesus. The other fathers trimmed their names as well. There were only so many pictures in Brother Paul's wallet.

Having avoided one date with the headsman, we tried our luck with the luggage.

"What is this?" the junior agent said with the exposed skin at his arms showing dark gray. We'd been warned that when Kri'ronkis arm flesh showed dark there was a serious likelihood that blood was about to fly. Yellow was a happy color. We Jesuits had swapped the traditional somber black of our cassocks for something we hoped would be more life-enhancing. Jesuits were nothing if not flexible.

"That is a windmill," I said, letting both of my hands wave gently as in a soft breeze or easy sea current, fingers fluttering softly as well. Nothing hard. Nothing threatening. Everything friendly and safe and nice to have around. I didn't bother smiling. Evolved with exoskeletons, the Kri'ronkis had shown a definite lack when it came to reading facial expressions. The junior agent spun the vanes. They were folded for travel. When spread, they'd be several meters across and move at the slightest breeze. The ball bearings hummed, the turbine behind it whirled.

The senior agent clicked his razor nails on the stone table. "It makes little lightning sparks and carries all those other strange things of yours so they light up like torches. Yes?" No easy hand movements for him. His killing fingers said it all.

"Yes, but it is pushed by the wind," I managed to get out, but he had already given a slashing sign to the junior agent who was waving for the menial to carry all the windmills into the lock room. The same happened to the air conditioners, which would have done us no good without the generators. But when they objected to my toothbrush and comb because they were rubber and our deodorant and aftershave even though we'd put them in clear glass jars, it was hard not to log an objection.

The ambassador stepped forward. "You have to realize, the more you buy on the local economy, the more silver they get."

"But they don't have medicinal alcohol," I pointed out.

"And what they drink is horrid," the ambassador sighed. "Yes, I know, but nothing is going to come of a protest. Nothing good. Remember those sharp things. And we have no appeal rights here. None at all."

The Firantans pretty much proved that.

And I was here to save souls for Christ, since the Holy Father had determined that the Kri'ronkis were to be given the value of the doubt. Save souls and see about trade. All for the greater glory of God.

Now the customs agent was going through our religious objects for the chapel we'd been promised. The incense passed, though it was quickly held at arm's length. The Kri'ronki could smell, but their tastes and ours were far apart. The beeswax candles got the same reaction. I stood close as the nativity scene got looked over. Wooden stable, ceramic figures. Nothing high tech here. "Hand-painted," I pointed out. "By German nuns" just did not translate.

Then the customs agent dropped the donkey.

It bounced.

Razor-sharp fingers pointed the

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whole scene for the locked room. I retrieved the donkey; the bottom explained the problem. "Hand-painted by German nuns," I told the Reverend Father, "but they contracted out the figures to Buddhist nuns in Thailand. Guess they used the latest ceramic technology. You could probably stop a 9mm slug with these."

"What will we do for a nativity scene? We *are* going to celebrate Christmas?" Brother Paul's voice captured all the sadness of his grandchildren.

"We will work something out," Father Superior said.

A half hour later, we were reduced to little more than our clothes baggage and two forlorn boxes of chapel supplies. The ambassador hired one of the menials to carry the load to the embassy that was being turned over to us and seemed eager to return to the shuttle when a Kri'ronki of a different order walked into the customs house.

His pantaloons were in a green and yellow strip arrangement and he wore a shirt like the customs officials, only his was green with a red frill down the back. He also wore a wide-brimmed hat. Four of the fingers on each of his hands had nails grown to gleaming sabers, including both of the opposing thumbs. Suspicions were that the more and longer the nails were, the less likely the man was to do any manual labor. That was the way it worked in ancient, Imperial China. The xenoanthropologists had so far failed to verify the hunch, but looking at the situation in real life, it certainly seemed more likely than not.

The ambassador bowed to the Kri'ronki, who took a puff on his cigar, blew smoke at the Earth rep and nodded his head. "So happy to see you among us again," he said, rolling and clicking the words out.

"So happy to be among you again," the ambassador replied. Though his body language said anything but, his hands waved softly, properly, gently.

"I smell that you have brought us little brothers to sit at our feet, warm the rocks and learn the proper ways of the people."

"It smells that way to me as well."

"Good, good, good. With great sorrow, I must tell you that one among us has failed miserably in his duty to clutch and kin. He will pay the full price for his failure to behave with proper decorum when the sun falls below the level of the highest tree this afternoon. You will, of course, bring your younger brothers so that they can see and learn."

The ambassador looked pale. "Yes, Great Father Ros'kamoni, I will be honored to lead my younger brothers to such a lesson before I depart for far away lands."

"Oh, must you go?" the Kri'ronki said, blowing smoke again at the ambassador.

The Earthman looked in desperate need of a coughing spell, but held it in with truly heroic effort. The Jesuits had been told it was best to ignore the somic herb. The ambassador was certainly going to heroic measures to do just that.

"I am called home by my children and children's children," the ambassador said. I knew for a fact any kids he had were bastards. But the fiction worked. The Kri'ronki ambled on.

Quickly, the ambassador led us across the dirt street to where a small grove of trees grew. Leaning against one, he gave himself over to a long fit of hacking and coughing. "Damn that stuff, and they do blow it in your face every time you meet one of those upper-class types. I hate it."

"Do you think our body odor bothers them?" I asked.

"That's what some say. Me, I can't smell a thing from them. But this whole place reeks to high heavens," the ambassador said between hacks.

"Maybe they suspect we're interest-

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ed in it?" I said.

For the first ten years after Kri'ron's discovery, the other races had ignored the difficult lobsters. Then we humans landed and some Walter Raleigh wondered if the somic weed might be a nice new drug. He snuck some off-planet to study and synthesize.

And it turned into something rather more exciting, something with a multi-trillion-dollar potential when full analysis was done. The mitochondrial DNA in the somic cells was the perfect power pack that ten space-traveling species had been looking for to power their nanites. Nanos are neat, but something that small is hard to get power to. The right battery to keep them going had eluded everyone . . . until someone plugged a somic mtDNA packet into a nano gadget and watched it run around like a bunny beating a drum for over a year.

Bingo. Everyone wanted the stuff.

And no one could get a hand, tentacle, or other extension on a single leaf.

Earth couldn't grow it, at least not and get the right mtDNA out of it. None of the other nine home planets of the space faring races could grow it right either. Not a single place on any other planet in all of known space showed any potential to grow the stuff with the right mtDNA. The first test of a newly discovered planet was to plant some somic. So far all had failed to produce what we wanted.

All except Kri'ron. And they didn't want to talk about trade. Or much of anything else.

"Is this poor miscreant the execution we were warned about?" Father Superior asked and I returned my attention to what seemed to be a full-time job on Kri'ron: staying alive.

"I'm afraid so. Usually they wait a couple of days before subjecting you to it. But I guess with everyone beating feet out of here, they want to make their point, maybe encourage you to go as well."

"That is why we are here," Reverend Father said. "We will go. Will you take us there?"

The ambassador's "yes" had "no" all over it.

The Earth embassy was a single-story brown sandstone building forming a square around a central garden that also served as the latrine—plumbing, central or otherwise, not being in fashion among the locals. A separate building had been rented for our chapel. From the smell of it, its former use had been a stable—or worse.

Brother Paul looked it over and shrugged. "Give me a broom, hammer, nails or whatever they use for them and a couple of weeks and I'll have this place in shape for a high mass."

He said the same for the kitchen. Our bedrooms had been formerly used by Earthmen; they were habitable, if in need of cleaning. Apparently, the idea of hiring a local maid did not occur to anyone. Then again, what would a room look like after a Kri'ronki had done what they considered a cleaning job on a wooden bed, table, and chest of drawers, all of Earth manufacture?

A search of the embassy turned up one ratty broom and no cleaning supplies; Brother Paul began making a list and missing his personal computer. Even paper and pen did not make it through customs. Surviving here was worse than primitive.

The sun edged lower in the sky and lacking a watch, computer or any other way of keeping time, we guessed it was time to join the ambassador. He was waiting for us in the shade of the trees across from the embassy, taking advantage of a faint breeze. Without a word, he led us to the place of execution.

It was not far away, along the bay, in a small inlet. A thick stake about twice as tall as I am had been driven into one of the less muddy parts of the mud flats. Various parts of Kri'ronki

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shells lay half imbedded in the mud around it, evidence of earlier executions.

A large crowd of Kri'ronkis formed an impenetrable semicircle to landward, but they made way for us when Ros'kamoni joined us and led us to the front where several Kri'ronkis of his dress and apparent stature were lounging on cushions provided to them by a hawker who also offered us the loan of them ... for a price.

Father Superior started to reject them with a haute shake of his head, but the ambassador cut him off. "Don't lower your status. Upper class sits here. Lower class stands. We aliens have fought hard to be taken as upper class. Don't screw us up."

We rented cushions.

The crowd was noisy, but I only tried to follow the conversations among the upper class seated around us. The weather was hot, something I could agree on. The ball game season was going dismally and players wanted too much pay considering how poorly they played. All very familiar.

Of politics, finances, or many other topics I'd have expected, there was not a word. I'd been told that twenty years of talking with the Kri'ronkis had never gotten past these two points of interest. I admit that I had doubted my government briefers were leveling with me as a Non-Government Official and as a Jesuit. From what I was hearing at the moment, I owed them an apology.

The noise level reached ear-shattering levels. Question: did Kri'ronkis have ears as sensitive as ours? Once more I felt the lack of a computer, a recording device. Even paper.

Off to my left, two Kri'ronkis led a third between them across the mud flats. The guards were in official livery, much like the customs agents, though with less yellow piping. They did have three fingers on each hand grown into razor-sharp weapons. The poor creature between them had two of his fingers hacked off, apparently his sharpened nails, and was stripped naked. If there was a male appendage to be seen, it wasn't visible to me. With stumbling step and trembling arms, he was led by ropes around his neck to the stake.

The guards tied the prisoner's ropes to it with plenty of room for him to walk around, much as we might stake a sheep or cow out if we wanted it to attract a rogue tiger for a hunter. The guards withdrew and the prisoner just collapsed into the hard mud.

Not much to see, so far. But this was why I was here.

For twenty years, the Kri'ronkis and the space faring races growled at each other. The Kri'ronkis refused to let us bring personal goods on-planet for our own use and they insisted that their law, some would say lack of law, applied to all who walked their muddy backwater. Humans weren't the only ones who objected at replacing their ambassadors on an regular basis when they lost an honor duel.

Then, twenty years ago, about the time we decided we really wanted to trade the Kri'ronkis something for somic, they added this mandatory attendance at an execution for every arriving delegation.

First reaction was just plain shock. But when the weapons makers got the first report of how the execution went, shock turned into unabashed drooling. Every army wanted whatever weapon it was that was killing those Kri'ronkis.

The race was on to get a sample.

Around me, Kri'ronkis began shouting, "One. Two. Three." At "Four" the poor victim was on his feet, yanking at his rope and bellowing in pain. From the air holes in his shell, green blood dripped onto the mud, drawing the hungry attention of insects. Something fell off him to splat in the mud and a flock of flying things—the local equiv-

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alent of scavenger birds, no doubt—began to circle. The standing Kri'ronkis behind me were cheering as well as calling out, "Five. Six." The upper class beside me smoked their somic and discussed how well or poorly this one was dying. Consensus seemed to put him about middle of the road.

I stood up and bowed deeply from the waist.

The dying Kri'ronki made a lunge against his rope, failed to break it, and fell face down in the mud. His legs and arms convulsed. His body twisted in agony, as much as his shell's articulation allowed. Then he lay still, his last shriek passing into a low moan before finishing as a gurgle when much of what once had been him dribbled out the air holes and now disjointed knees of his shell.

Behind me, cheers and jeers fell silent. On one side of me, the ambassador started edging away, as much as he could move his cushion. On the other side of me, the Kri'ronki known as Ros'kamoni looked up from among the sudden silence of his associates. Two of his killing fingers drummed into a cushion, leaving deep imprints in the cloth.

"You bow to a criminal, duly convicted by a proper court of my Lord."

This mob had come to witness an execution. Aliens though they might be, I could feel their eagerness for more killing. But I had planned my words for three years.

"Is not the journey from life through death into the unknown worthy of respect?" I said, each word pronounced just so. My bow now turned toward Ros'kamoni.

"Hmm," he said, using one of his saber-like fingernails to slice in half a bug that flitted between us. His "hmm" had a lot of rumbling in the back of his throat and a couple of clicks thrown in for emphasis. His nail never came closer than a foot to my belly, so my knees managed to keep me upright. Barely.

"You think strangely. But you are not from around here, so it is only proper not to be surprised by that. Come tonight, sit with me in my box and watch the ball game. Maybe you can see some way for the Blues to break their losing streak."

I bowed deeper, said I would be honored, and collapsed back onto my cushion.

"Well done," Father Superior whispered. He had approved my action as well as promised absolution for whatever sin of pride or self-destruction it was that drove me to attempt it. I believed then that the need to separate the Jesuit delegation from the government and corporate ones that had come before was critical and necessary if we were to both save souls and succeed where others had failed. At the moment, I sang a soft Te Deum in thanks for my life and tried to regain my strength for the walk home.

On the mud flats before us, the poor Kri'ronki was reduced to nothing but his shell. Whatever had done it was what the weapons makers had spent five years trying to get their hands on. And when they finally did, they found they couldn't handle it.

The ship bringing it back to Gir arrived on automatic. All aboard were dead. Flesh gone. Nothing but a pile of bones. Remotes sent in to sample the contents of the ship failed before they could send back any significant data. Other races were invited to try their hands, tentacles, cilia, whatever on the problem. They failed.

Then containment began to fail.

Suddenly, reps from ten space faring races had a single and enthusiastic interest in solving that problem. Saving their own hides. Literally. They tried many approaches. All failed. Hastily, the ship and its Kri'ron samples were taken to a spare sun and crashed into it.

At last report, the sun was still there.

Mutterings among the hotheads had

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changed from "Let's invade the damn place if they won't give us the somic" to "It's got to be vaporized down to bedrock. Anyone who has weapons like that can't be trusted."

Religious leaders on nine planets were still struggling to hold that talk in check. Those efforts had spawned ecumenical meetings. And those meetings had led to the idea of a religious mission to Kri'ron. The Jesuits had lucked out or drawn the short straw. I was none too sure at the moment which fit the situation I found myself in.

Still, the word was that if I and the Jesuit delegation failed, armies might roll. Might.

Executions like this one had even the most chomping-at-the-bit generals a bit edgy. Generals liked to win wars they start, and rolling tanks over a bunch of lobsters sounded like a great way to an easy victory. But those empty shells of prisoners, that ship's crew stripped to their bones? The computers that quit working, nanos that vanished. Decidedly spooky stuff. Less than interesting.

I personally knew of several two- and three-stars back on Earth burning candles and joss sticks, spinning prayer wheels, and sending up other forms of heavenly petition for my success.

Fr. Garnni offered me a hand up. Both he and Fr. Sanchez stayed close as we made our way home. The ambassador parted ways with us as we passed a dirt track that led to the shuttle.

"You Jebbies may not put yours to much use, but what you did back there sure took balls," he said in what I took for a compliment. "Enjoy the ball game," he added with an evil grin. "Ros is such a great guy."

Ros'kamoni stopped by the embassy to collect me for the ball game. The walk to the game park consisted of talk about the weather and whether or not it would be hotter tomorrow. Ros'kamoni chose the topic and did most of the talking. The talk at the game was about how poorly the Blues were playing and whether they could get worse. No talk of death, the afterlife. No reference to what I'd done that afternoon.

Maybe that was just as well.

I tried to understand the game.

My briefers had been vague in their description of the game. When pressed, they admitted to spending way too many hours of their time on Kri'ron at ball games.

I confess that I had thought ill of them. But then, I had tried for ten years to understand cricket. It had been explained to me by some of its most avid aficionados. I still failed to see any purpose in it. Then again, as an American, my attitude toward our own national sport is only slightly more enthusiastic than watching mud dry. Suffice it to say that the Kri'ronkis are mad about a similar game in which people throw balls, others hit the balls and then run somewhere.

Only in their version the places you run to seem to change depending on where you hit the ball. Even after four months of nightly ball games, I could be wrong on that. Maybe there are three or four kinds of ball games, all similar, all different. I don't know.

The only bright spot about the game was that the Blues won and Ros'kamoni had good things to say to me. "You are strange. But maybe you are luck, little brother. You must come with me tomorrow night."

And as we parted company, he tossed the butt of his cigar into a bush beside the embassy. I waited until he was well gone, then retrieved it. Back in my room, I unrolled it and found several seeds. What if I started smoking somic? What if I started smelling more like they did? Would they be more comfortable around me?

I felt the rush of a dark unknown

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roaring at me as I went hunting for Brother Paul. He was in the kitchen, making a list of things he needed on a green slate board with chalk. Why hadn't I, thought of something that clunky?

"I need a couple of pots to grow somic in our garden," I told him.

"Planting pots," he said, scratching away on the slate. "If I can find some, you'll have 'em."

Next afternoon, we were rather more surprised by what else he found.

"Look what followed me home," Brother Paul said as he entered the kitchen where we were munching dried crackers and drinking tea for our lunch. He waved at a Kri'ronki visible through the open window who rested in the shade of the chapel.

"Who is that?" I asked.

"Who is she," Brother Paul corrected me. "She's one of their women."

"She is? How can you tell?" Father Superior asked.

"The rare ones you see in public wear those dark blankets," Brother Paul said. "Anyway, she followed me home. Can I keep her?"

"You leave a trail of breadcrumbs?" I asked.

"Nope, had to use slices of hot dogs, like my oldest kid did when he brought home his first stray dog."

"*Is* she a stray?" Fr. Sanchez asked.

"What is she?" Father Superior wanted to know.

"I don't know," Paul admitted. "The cooks, the building maintenance from the earlier Earth delegations, the few working stiffs who survived to get home and talk to me said they saw women moving around at the market and going about on other errands. You can tell them cause they're always under those blankets, though you notice it doesn't cover their faces, just their body. The guess is they're slaves, prostitutes, the lowest-class menials from the families too poor to keep their women in pardah or hareem or whatever they do with the rest of the gals we never see."

"And her? Which is she?" Father Superior asked.

"I don't know." Paul shrugged. "I was asking around the market, using mostly arm waving to show 'em what I needed. You've told me often enough, Frank, my Kri'ronki is horrid on the ears or whatever they got. Anyway, I must have been the best floor show the market ever had cause everyone's laughing and pointing at me but no one's offering me anything until she sidles up to me and asks me if a "ti'kogua" is what I'm after. Only instead of trying to do that horrible thing you do to your throat, she just rapped on her shell. I made sweeping motions and said, 'Yeah, I need a broom, a ti'kogua,' and rap on my slate and off we go.

"Listen, Father Superior, can I give her one of those small silver pennies you brought? 'Cause she not only helped me buy everything, including those pots you wanted, Frank, but she hauled most of it home for me. I couldn't have gotten it home without her."

"We must not bind the mouth of the kine that grind the grain," Father Superior intoned, a solid scripture quote in support of social justice.

I'm all for social justice, but were the Kri'ronkis ready to apply it to the other half of their race? Would we survive suggesting they do?

"Will we get in trouble befriending a woman of the lowest class?" I eyed Paul. All the other delegations had steered clear of the Kri'ronkis womenfolk and the problems they might bring along with them under those blankets.

"I don't know," Paul said once more, then frowned. "Maybe I do. I kind of told her about the chapel and how we wanted to build an altar and some pews and reclining benches for Kri'ronkis so we could say mass."

"All that?" I couldn't help but say.

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"Maybe I cut a few corners here and there. Anyway, she took me to see these four guys. I think they were brothers. Maybe hers, but with crawfish, how you gonna tell a family resemblance? Anyway, they said they'd be willing to work on remaking the chapel for us. For silver, of course. And they didn't seem to have any problem talking to her or with her talking to me. Maybe they preferred talking to her more."

"Can't say that I'd blame them," Fr. Sanchez deadpanned to me.

"You guys want your supper before or after tonight's ball game?" Paul asked with clear and malicious intent.

Supper was only going to be beans and rice, but it had to be better than anything offered at the game park. "I'm sure the brothers will enjoy talking to you when you explain what we need," I told Brother Paul while giving Sanchez a gentle elbow in the ribs.

So we all slipped out to meet Kova, as Paul introduced her to us, and she seemed most grateful for her silver penny as she bowed low and left for wherever she came from. And Brother Paul dispensed his purchases, including my pots.

"I can't buy knives or anything sharp," he told us as he put dinner on. "Some kind of rule. But I told Kova about how I need to carve a new nativity set to replace the one that customs wouldn't let us have and she said the brothers would lend me some knives and sell me some wood to carve. We're going to have a nice set for Christmas. How long is it until Christmas?" he said, sounding very much like one of his kids must have long, long ago.

Father Superior decided that the Church's liturgical year should be harmonized with the planet's 419-day year and Kri'ron was just past its summer solstice. Its longest winter night seemed a long way off. Easter would be a bit harder to determine, what with the planet's two moons, but Christmas was a slam-dunk.

Days pass slowly when you are trying to crack a communications code that a species has developed over several million years and all you have are your own two eyes to observe it with, your own two ears to record it with . . . and no memory aids. Without cameras to record, without computers to analyze and store, without anything but my own mind and body, I knew I was missing 99.9 percent of what was going on.

Others before me had tried and failed. Failed and gone home or failed and given vent to their rage and been shipped home with their bellies split open from neck to groin for giving offense to one or more Kri'ronkis nearby.

Any kind of electrical recording device that might have helped us never got to first base, so to speak. Anything large enough to be noticed by customs got impounded. Anything smaller suffered the same fate as the stuff that tried to examine the contents of the dead space ship. It died. We were the proud, the space faring races. We'd conquered the distance between the stars. We could handle a minor thing like lobsters.

Yeah. Right.

Our technical experts figured it was just something in the atmosphere of Kri'ron. They retreated back up to orbit and sent down more probes. The probes told them nothing before they too went belly up.

There was something unique about Kri'ron. Something that let it grow somic. That wrecked our nanos. That made its people so cantankerous and unwilling to talk about anything modern. Anything new. Anything more up to date than the second millennium Before Christ.

So for four months I attended ball games. I talked about the weather. I talked about the ball players. I told

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men of the true men how good their sons looked. Always sons. Never daughters.

Usually I said things right. Not always.

There were times I came home early from the games bleeding from facial cuts. Brother Paul stayed up nights waiting for me.

"What'd you say wrong this time?" he said as he opened his simple med kit.

"Oh, God, I wish I knew. I thought I had it just right. Dal'kongi said we should expect rain. It smelled humid, but not like rain to me. I was so sure I knew how to express a contrary opinion politely. Still, he challenged me."

Actually, I'd been working my way up all night to asking Ros about what he thought about the four carpenters working on our chapel having a woman underfoot. They and Paul and Kova had started work that morning and I figured if we were going to have the morality police show up, maybe I could get them aimed at the four brothers, not us. But I tried to argue about the rain first and got slashed.

"Only to first blood," Paul pointed out, applying antiseptic that had to be taking years off of my time in Purgatory.

"Yes. Only to first blood. I can thank Ros for making them hold at first blood. I think he finds me 'interesting.' Either that or they're not finding much honor in slicing up a man who just stands there facing them. I won't cringe. Won't beg or try to defend myself. Not that any of that would do me any good."

"Maybe it's all of the above. I'm gonna put a couple of stitches in this one. This big bronze needle's gonna leave a scar."

"Brother Paul, I'm really not worried about frightening off the girls at the singles bars."

"Well, I just thought I'd warn you. If my little granddaughter takes off running from you when we get back, I don't want your feelings hurt none."

"That's what I like about you. You really think we'll get back."

"Yep," he said, finishing up his stitching. "Don't you go developing any twitches like that tusker and I expect that at least I'll get back. Not so sure about the rest of you fellows, though."

"You sure you'll make it back? If there's a Girl's Rule day on the Kri'ronki calendar, Kova just might make you an offer you can't refuse."

He paused for a moment to gaze out the window and I knew I'd gotten too close to what he and his wife had shared for fifty years. I wished I could take my words back but he shook it off in a moment.

"Worse fates for a man than spending his life with a woman like Kova. She is a might fine woman. Mighty fine."

I didn't remind him that he, like me, was now under a vow of celibacy. And somehow the work got done on our chapel and no one with whips showed up to object to Kova working on it with the carpenters . . . and with Brother Paul.

As the weeks went by, I got cut up less and Brother Paul started on the nativity scene. Of course, Kova helped him get the planks for the miniature stable and find something like straw to go in it.

About the time he started on the statues I got my bright idea.

The Kri'ronki's shell did not cover all of their body. There had to be openings for cooling air . . . water before they came out of the ocean. Much of the inside lower arm of a Kri'ronki was visible during conversations and we'd already noticed that the mottling on it often chanced color. Some colors were pretty obvious. That was why we Jesuits had traded our black cassocks for yellow. I started to notice other colors and the apparent attitudes con-

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nected to them. It was hard to keep track. I was so used to my memory aids that I'd forgotten how to survive on raw brain power alone. I'd make an observation, draw my conclusion, then do my best to remember it until I got home—while also doing my best not to do anything that got me killed in the meantime.

Brother Paul's slate tablet was too limited for my needs. He bought me paint and Kova rustled me up small brushes. I began making notes on my bedroom walls. Then the hall walls. Correlating the date was none too easy, either. What I would have given for a simple search function that worked on walls.

Still, I and the other priests kept at it, adding to each other's observations.

"But what do we do with all this?" Father Superior asked.

"It may help us know how the animal part of their brain is reacting to what we're doing, what we're saying, so we can cut short a conversation before they cut us short a head," Fr. Sanchez pointed out.

"But we are still left talking with only half a vocabulary." Fr. Garnni said.

"Unless we can somehow add this to our conversation," I said, pacing the hall, thinking, ignoring all the high-tech solutions that came to mind. I tugged at the sleeve of my cassock. "We changed this color to avoid saying something we didn't want to . . . If I. . . ."

I pulled out a handkerchief from my pocket, draped it over my lower arm. "Now I'm no longer happy. I'm . . ."

"But some of the yellow bleeds through," Sanchez said.

I rolled up my sleeve. Wrapped the white hanky over it again. "Better. And if we dyed several handkerchiefs different colors so that I could change my 'body language,' as I changed my intent. . . ."

"I could get some dyes," Brother Paul said. "I haven't seen any in the market. Dyed cloth is kind of upper class, but I'm sure Kova knows where we can get some."

"Then we might have a new way to get our intent across to these crabs," I said slowly, "a new way to talk to them, a way that might make up for some of the things we say wrong. Wave some colors so that their cilia are telling the back of their brains the things that we want them to hear, not screaming the wrong thing for what we're saying."

"It is worth a try," Father Superior concluded.

"You can have my handkerchiefs," Fr. Sanchez said. "Mine too," Fr. Garnni said. "I'll toss mine in as soon as I get the dye," added Brother Paul.

"Just don't add blood to the dye," I told Paul.

He or Kova had borrowed a carving set from the brothers who did the work on the chapel. But the knives were bronze and didn't hold their edge all that well. The wood here was anything but soft. The end result was poor Brother Paul's fingers were showing more cuts than my face ever had. But he applied bandages and kept carving. I had done the same. I think we are kindred souls. Stubborn before the Lord.

A week later, I was ready to show my colors. As luck or the Holy Spirit would have it, the Blues had actually patched together a three-game winning streak. I invited Ros'kamoni to drop by the embassy to discuss matters the next morning. I got up early for mass, then waited. And waited. And waited.

Ros'kamoni showed up shortly before noon, showing yellow around the elbows. Today had all the fixings for a good day. I invited him into the room we used to receive visitors. The walls were a soft sand color, the ceiling a gentle blue. The windows were large and open to whatever breeze happened by. In the middle were a locally made stone table, a wooden chair for

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me, and a stone reclining platform for a Kri'ronki that usually left them a good three inches higher then me.

Ros'kamoni trotted to the platform when I indicated it with a bow. He scratched most decorously at the bulge of his reproductive organ in his green and yellow pantaloons before settling his six legs among the gaily-colored cushions. He did this from front to rear, right to left, a "very proper" order for a male, and made sure the red ruffles running down the back of his sleeveless shirt were properly aligned. He also made quite a show of adjusting the excess flesh that leaked at every opportunity from his shell. Not only did he have the eight saber-deadly fingers, but his extra padding blocked his air circulation holes, demonstrating for all see that he did no manual labor. There was a reason the ball games were in the cool of the evening.

I made all the proper admiring sounds that I should to one so obviously well fed and sexually satisfied. Then Ros'kamoni blew somic smoke in my face.

I still had three somic weeds struggling manfully to grow in the garden. When Brother Paul tried to buy more for me, Kova had suggested not—and stepped on his foot to emphasis the not. "Aliens not buy somic. Inimitable Lord decree it."

I could hardly wait to show up with a cigar I'd grown and rolled myself.

"So, little father who has no children," Ros'kamoni began, the skin at his forearms showing a pleasant yellow-white mottle, "what shall we talk about this lovely morning?"

I'd gotten used to the insult. The Kri'ronkis had not forgotten Father Superior's close call at customs. No, they'd turned it into a running joke.

And I intended to tackle that joke head-on today. It struck me as as good a place as any to start my show of pushing back, reclaiming my honor as a man before the true men. I rolled back the cuffs of my yellow cassock, then pulled two pink linen kerchiefs from my breast pocket, unfolded them and laid them out to cover first my right arm, then my left.

"What would a wise big brother tell an eager-to-learn little brother on a morning that has begun so beautifully about how a little brother becomes a great father like you?"

Yes, let's find out something about how men and women get along on this crazy planet.

Ros'kamoni eyed me for several long seconds, not moving a muscle. Not so much as his irises twitching. Had I gone too far with just my question? I held my breath, said a quick act of contrition, the short form, Lord forgive me for screwing up.

As the seconds stretched I added prayers to Mary, Joseph, and my own patron, Francis Xavier, who'd faced the samurai of medieval Japan and died at the gate to China; please give me anything you can spare at the moment, was about all I could get out as I held my body in frozen immobility. I would not let any twitch, any flutter, cause a hard-wired reaction in one of those saber-sharp killing claws.

My saints' intercessions must have been efficacious, for God granted me a few more moments of life to labor in His fields.

"How does it happen that your Arbiter of All Proper Behavior allows bad things to happen to those who submit in supplication and allegiance?" Ros'kamoni said, bringing up one of his long, deadly nails and using it to pin a six-legged bug waddling across the polished top of the stone table between them.

A pent-up breath escaped me slowly. I wanted to jump up and down. I wanted to cheer. Four months of inane conversations for me, forty years of bland blabbering for ten sets of diplomatic relations, and finally a question

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that didn't have to do with the weather, the last game. The next game. How cute his son or grandson was. Finally, a question that showed a Kri'ronki could hear someone else beside himself.

And he asked me about God!

Slowly, I drew in my next breath, mind in a dozen different races. I was here to save souls, first, last and foremost.

But—

Ten space faring nations were also expecting me to crack open a door that government and corporate efforts hadn't even budged. Trade. Trade in goods. Trade in raw materials. Trade in somic. Trade that might prevent a war.

I wanted to rub the shock from my face, give out a good Irish war whoop of joy, sing a Te Deum to God. What I did was begin to painfully structure the conversation I and a dozen of the best minds in the Society had been planning for the last three years.

First, I changed the linen at my forearms to the light blue that often accompanied questions when Kri'ronkis really wanted an answer, as opposed to the deep gray, almost black that accompanied questions meant as jabs, attacks, kind of "I know what's right, why don't you?" sorts of things. I would also need to change some of Ros's words a bit. What he'd actually said wasn't exactly what the Jesuit brain trust swore equated to God. Close, but no plenary indulgence. And I'd want to slip the word "trade" in.

"Would you have those who give their allegiance to the True Arbiter of Reality and Proper Living trade their submission to Him for success in this world?" I kept my hands waving gently, like sea grass in a gentle current, palms open, fingers flowing easily. By the time I finished rolling my R's, clicking, gulping, and making the other sounds suitable for polite conversation here, my throat ached.

Across from me, the Kri'ronki's skin went pale white mottled with reds and greens as his irises closed to pinpoints and two of his three eyelids came down. His normal fidgeting among his cushions ceased midway through my question. He sat poised for fight, flight, thought, something else I couldn't imagine while I wished again for a camera, any kind of recorder so that the mistake of my last moments might not be lost to humanity.

And Ros's iris expanded, then contracted again. The fingers with the lengthened nails twitched as his forearms darkened.

Into Your hands I commend my spirit, Oh Lord, I silently prayed. There was no use trying to run. I'd watched their ball players. Ros'kamoni might be overweight and out of shape, but I'd be dead before I took a step.

"One who has the wisdom to give over his allegiance to his superior cannot expect to trade on such wisdom," Ros'kamoni said, his body still frozen in statue mode. One claw moving slowly toward me.

"My words were poorly spoken, big brother," I quickly said, hands open, palms up in surrender on my lap. I'd been granted a second chance. My best bet was to make like a rock, but I needed to change the linen at my arms. I risked slow movement as I switched back to childish pink.

"Little brother has clearly failed to understand what is good manners and begs correction." Such pleas for education had saved a few lives. *Very* few. I hardly breathed as the knife-sharp fingernail twitched closer.

Then the deadly hand changed directions, hooked the rolled smoking weed from the ashtray, and Ros'kamoni gave that clicking guttural thing that passed for either laughter or cheering for the Kri'ronkis. He glanced away from me, then let his eyes settle on the gathering clouds out the window.

"We may get rain this afternoon.

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Maybe my team will luck out and have the game called for a muddy field."

"Such fortune is a smile to be asked for," I said, feeling hope for a few more minutes of life even as I mouthed the idiom that no one had successfully translated. Then a thought came from somewhere deep in the back of my brain where the Holy Spirit dances in the dark.

"May little brother ask," I said slowly, once more switching to light blue linen at my forearms and moving my hands slowly, palms open and up in supplication, "how one may ask for fortune to smile upon ones self?" If I couldn't get him to come to me, maybe I could figure out a better way to come to him!

Once again Ros'kamoni's irises went back to pencil-thin points, but only for a moment. Then his hands slapped the cushions, slashing through one and sending the local equivalent of feathers flying. He clicked and huffed like I'd seen Kri'ronkis do at ball games when one team had made a particularly spectacular play. Or at least they said one had. It also occurred sometimes at dinners. Apparently, this was the response one gave a good joke. I waited while the Kri'ronki batted the fluff about.

"Little brother, you do know how to break wind in a crowded room. You have the many balls of a tranko. The thick skull of one, too, but you have the balls of one. Fortune is not superior. She gives and takes no allegiance from anyone. She is a simple child who runs where she wills and pees where she may, and if fortune happens to smile at you, well, you smile right back, and run with all the balls you have. Ah, little brother. What swamp were you raised in to know so little of how True Reality turns and how we must live if we are to be a proper man of the true men?"

I bowed low in admission of the poor quality of the swamp that had bred me and, hopefully, in admission of defeat for the day. I'd taken about all of the proximity to Ros'kamoni's killer claws that I could stand for now. I needed time to report, regroup, rethink, get some blood back into what surely must be a pure adrenalin stream by now.

"May this one who seeks to know the true path for his feet take his leave?" I asked.

"One is always free to take a new path," Ros'kamoni intoned. "You will join me in my box at the game this evening. Surely my team is due another victory if rain does not wash us back to mother ocean."

"I would be honored in your company," I finished and backed out of the room. I wanted a drink. I wanted a cool soak in an iced bath. I wanted a solid hour in a frigid air-conditioned room. None of these were available. I walked a slow, sedate path to the chapel. I could pray.

No surprise, the chapel was empty. The other priests were about their daily business and it was rare to see a Kri'ronki within the shadows of its soft brown walls. Ros'kamoni had passed by the entrance once and pronounced the air funny-smelling. I inhaled a deep breath fragrant with incense and beeswax candles brought across two hundred light-years to give this one patch of strangeness a hint of Earth. Of course, it also carried the acrid scent of new-cut wood that had never been near Earth.

Kneeling, I crossed myself and tried to calm down, empty my mind, center myself on the image of Christ the King, Lord of all seated in the Last Judgment. Father Superior had decided that a corpus hanging on a cross might not give the Kri'ronkis the right idea and had instead brought along a hand-crafted replica of an ancient icon to hang behind the altar.

"Jesus, Lord of all, help your poor

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servant," I prayed softly. I remembered my brother sharing the grim humor of his pilot friends. "Any landing you can walk away from ain't bad, so I guess I didn't do too bad."

I'd managed more than walking away this time. I got Ros to ask about God. But I so totally fumbled the answer. I shrugged. But, hey, I walked away from my fumbling on my own two feet. *Not bad, Lord, don't you think?*

Jesus the Judge stared down from his throne and didn't seem all that impressed.

"Yeah, I didn't think I did all that good either," I sighed and sat back to think. Slowly, as my mind roved over the meeting, it niggled at this, gnawed at that, hunting for what had escaped notice in the moment. Before my Lord, absolute honesty was unavoidable.

"Any suggestions would be gratefully appreciated," I told the Lord Jesus.

The right-hand side door of the Chapel opened; Brother Paul came in. Beside him clopped Kova, carrying straw or grass. The two of them began arranging it in the stable he'd built. Then he started adding the animals he'd carved, explaining each of them.

"A stable with animals belongs in the place where you come to think on the correct way to live?" she said.

So he explained about how a great ruler ordered that everyone go to their home town to have their noses counted. "Any of your leaders do that? Count noses?"

"They count right claws. That what gets work done. Why bother with noses?"

"Right claw better," Paul agreed. "But there was no house to stay for this young pair when her time came to spew forth live young," Paul said, bringing out the wooden figure of Mary he'd painted. "So her baby boy is born here, in shelter for animals."

"Baby?" Kova said.

"Yes. You love baby. New young. Want to hold them close. Want to do nice things for them."

"Yes. They so nice," the Kri'ronki said, and seemed to be holding one in her arms, rocking it softly. "Very nice to hold. Sing to sleep. Love, yes."

"Just so," Paul said, bringing out his small baby Jesus. "I think that the Great Reality of the World wanted me to love Him, so He become baby and born by Mary. Loved by Mary, His mother. She loved Him. I love Him," he said, holding the figurine in his arms and slowly rocking it back and forth.

Kova took the wooden statue from Paul's arms, held the carving up to the light, then folded it into her arms and rocked it some more. "So you say Great Decider of all Proper Things was a baby with a mother."

"And He learn from her, too," Paul put in. "When searching wise men ask Him what the Great Reality like, He told them It like a woman who lost a silver coin and turned house upside down hunting for it. Hearing that story, I remember my life companion. She turn house upside down hunting for something she lost. Do Kri'ronki mothers go through everything hunting for something that lost?"

Kova seemed to be only half listening, if I was any judge of how much Kri'ronkis paid attention. She reached into the nativity and brought out the figure of Mary. She held mother and Son together, rocking them softly. Humming something.

"So mother taught little one," Kova finally said.

"Yes, and when he grew up, and his mother and He went to a wedding, a . . . Father Frank, is that you back there?"

"Yes."

"What's the word for marriage?"

"I'm not totally sure. Try *qui'sona*."

He did, rapping on the stable rather than doing the proper clicking noise in the back of his throat. Kova didn't mind. She was listening, enthralled, as he described the miracle of turning

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water into wine at the Marriage Feast of Cana. Or at least trying to describe it. I contributed a few more words, but Kova seemed to be getting the gist of it on the first try. Or getting as much as she was going to get. She was either one smart woman, maybe smarter than we'd given her credit for or very happy not to know much of anything. I'd come two hundred light-years to be mystified by the other half of someone else's race.

"Just so," she finally said. "You see all this in you heart?"

"Yes," Paul said.

"Born of Mary. Taught by her. Obeyed her. Became great teacher. Yes."

Paul glanced at me. I thought Kova was missing quite a lot of Trinitarian theology, but she had the basic story down. I nodded.

"Yes."

"I need statue Mary. Statue son. I must go. I bring them back, but I need them now and must go."

And with that, the centerpieces of Brother Paul's nativity scene galloped out the door right past me.

Brother Paul came to join me as I stood in the door, watching Kova trot out of sight.

"I hope she gets them back before next week." Then he shrugged and grinned at his bandaged hands. "I can carve a new set if I have to by Christmas mass. But I did get the Baby Jesus just like I wanted him. He had the smile and dimples of my youngest boy. Good Lord, but could he do cute, the little rascal."

The next morning, as I was finishing mass in what could be called the cool of the day, it was Ros'kamoni who brought the statues back.

"These are yours," he said, giving me a lower bow than I'd ever gotten from him before.

"Yes." I said, returning the bow.

"You have one called Paul here?"

Brother Paul had been assisting me at mass; I waved him over. "This is Brother Paul."

Ros'kamoni gave him an even deeper bow.

"Honored Father, you are summoned to the Council of the Mothers to tell them the story of this mother and her child," he said using perfect diction and syntax.

Council of the Mothers! What Council of the Mothers? I took a deep breath and got ready to step in way over my head as I bowed low.

"Pardon this little brother who was raised in a poor swamp, but what can you teach me about this Council of Mothers? My ears have never heard of such a council."

"And why should our Council of Mothers have anything to do with strange men who look so ugly? They have little enough to do with us men of their true men. But the story Brother Paul," and he not only got the title right, but bowed to the man, "told of a mother teaching her son the proper ways so that he might grow up to be the Guide on the Right and Proper Path has caught their interest in you like nothing that they have heard or seen from above the sky in so long.

"So come now. Brother Paul must tell the story and if he requires a word, you must help him. Move fast. We men do not keep those who are the Arbiters of Proper Behavior waiting."

Women were the Arbiters of Proper Behavior! I'd taken Ros's answer to my question about woman to be a question about God. But he'd still been talking about *women*. Dear Lord. But. But.

"But there have been women in the delegations before," I blurted out as I headed for the door. The first Earth ship that arrived on Kri'ron had been captained by a woman!

"You call those women?" Ros'kamoni said. "They dress like you men. They talk like men. They argue like men. Most of them did not even have pictures of their spawn. What benefit

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could the Council of Women possibly see in including them in their talk?" Ros'kamoni said, pulling us out of the chapel and pointing us toward the center of town.

"Though why they want to jabber with Brother Paul is beyond me. But most of what women do is hardly worth a man thinking about. We do what they tell us. They let us cover their eggs. What more is there to having a good life?" His arms seemed almost to shrug, as much as his shell permitted it. "Of course, it is nice if your ball team wins sometimes. If your spawn remember you."

I trotted along as Ros'kamoni set a fast pace. When old Brother Paul began to limp, the Kri'ronki actually pulled him up on his back and let him ride. Man, this was one man who wanted to please his womenfolk.

Dear God, but we and nine other races had totally missed the boat on this culture. We thought the women were property, owned by the men, hidden away. This had to be the biggest blunder in the annals of diplomatic history. At least the biggest blunder that didn't end in a war.

And once we Jesuits established that Earth had women of power and grace and, well, femininity, where would that leave us? Not at more ball games, I prayed. ■

IN TIMES TO COME

Our January/February 2005 double issue marks a big milestone for *Analog*: the 75th anniversary of its founding as *Astounding*. We have a particularly fitting way to start it off: with the first part of *The Stonehenge Gate*, a new serial by Jack Williamson. Jack's personal history is literally astounding: his life has run from covered wagons to computers, and his work has appeared in this magazine in every one of the eight decades of its existence. At 96 he's still going strong, and *The Stonehenge Gate* offers a heady blend of old-fashioned sense of wonder and cutting-edge science, ably illustrated by Vincent Di Fate.

We'll also have stories and articles by a wide range of authors both old and new, including James Gunn (the conclusion of his "Gift from the Stars" series), former editor Ben Bova, David Brin, Richard A. Lovett, Kevin J. Anderson and Rebecca Moesta, Jeffery D. Kooistra, and Michael A. Burstein. Thomas Donaldson's fact article looks at some new angles on the prospects for extraterrestrial life; and Stephen L. Gillett, who's been working on updating and digitizing Mike Ashley's index to the first fifty years of *Astounding/Analog*, offers "*Analog* Computing," an intriguing look at the changing shape of *Analog* in particular and science fiction in general over the last 75 years.

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THE REFERENCE LIBRARY Tom Easton

Polaris, Jack McDevitt, Ace, $?, ? pp. (ISBN: . . .).

Behemoth: ß-Max, Peter Watts, Tor, $24.95, 300 pp. (ISBN: 0-765-30721-9).

The Donor, Frank M. Robinson, Tor, $24.95, 368 pp. (ISBN: 0-765-31086-4).

Bengal Station, Eric Brown, Five Star, $25.95, 277 pp. (ISBN: 1-59414-212-2).

Hot and Sweaty Rex, Eric Garcia, Villard (Random House), $24.95, 336 pp. (ISBN: 0-375-50523-7).

Heroics for Beginners, John Moore, Ace, $6.99, 247 pp. (ISBN: 0-441-01193-4).

Catwoman, Elizabeth Hand, Ballantine Del Rey, $6.99, 275 pp. (ISBN: 0-345-47652-2).

Free Culture: How Big Media Uses Technology and the Law to Lock Down Culture and Control Creativity, Lawrence Lessig, Penguin Press, $24.95, 347 + xviii pp. (ISBN: 1-59420-006-8).

This month's column is my 300th Reference Library. My first was a one-off in the October 1978 issue. The next year I asked Stan if he happened to want another book reviewer, and he said that as a matter of fact, Spider Robinson was wanting to ease off. In the July 1979 issue I therefore started alternating with Spider. By 1982, the job was all mine, as it has remained ever since.

It's a choice gig—all the books I can read, for free, and then I get paid to gab about them—which is perhaps why I never dreamed that the job would last so long. If I can just keep going a little longer, I will even surpass P. Schuyler Miller (278 Reference Libraries plus reviews in another 27 issues before the column was inaugurated in October 1951), who began in April 1945 and ended in January 1971.

But that's enough of a brag, at least until I hit Number 400. Let's get down to business. . . .

Jack McDevitt's second novel, *A Talent for War* (reviewed here in July 1989), introduced Alex Benedict as an amateur sleuth sifting through the lies and omissions of history to find a treasure. Many years later, after impressive success, McDevitt returns to that character, who is now a dealer in antiquities well known for his skill at finding unique treasures. In this effort, he has the remarkably able assistance of Chase Kolpath. And in **Polaris**, they face a grander puzzle than any they have faced in the years since their introduction.

The *Polaris* is a starship, captained by Maddy English. It is carrying six celebrity passengers: Nancy White is a media personality. Garth Urquhart is a one-time politician. Martin Klassner is a cosmologist suffering from a mental deterioration rather worse than Alzheimer's. Warren Mendoza is a microbiologist. Tom Duninger has dedicated his life for decades to the search for immortality. Chek Boland developed the technology for mindwipes and used it for years on criminals, but he recently decided that it is just another sort of death penalty. And

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they've all been invited to watch as a white dwarf collides with a star. Other ships carry the researchers who are there on business.

When the show is over, the ships head home, one by one. When it is *Polaris*'s turn, Base receives Maddy's "Departure imminent" signal, but the *Polaris* does not show up. A rescue mission soon finds the ship, but no one is aboard. The AI has been turned off and can reveal nothing. The shuttle is in its berth. All spacesuits are in place. There are no signs of violence.

Shades of *Mary Celeste*!

Sixty years later, despite a great deal of investigation, the mystery remains a mystery. That's when Survey releases a number of personal items such as jewelry and uniform jackets for sale. Alex and Chase acquire some of them just before an apparent assassination attempt blows up the building holding the rest. Their curiosity piqued, they start poking around and find odd coincidences. Duninger's lab burned to the ground. A high Survey official vanished. Someone is trying to steal, buy, or at least examine the few artifacts that survived the explosion, and a woman involved looks so much like Maddy that she must be a relative. And then there are the attempts on their lives. . . .

Any aficionado of mystery fiction knows that you just don't tick off an amateur sleuth! It only motivates him! It is thus not very long before Alex and Chase are pursuing the mystery more intently. They make progress, too, all the way to a long-abandoned space base where the truth is revealed to all those readers who didn't put the hints together much earlier.

And of course, I can't tell you what that truth is. You'll have to buy the book to find out. When you do, I'm sure, you will enjoy the read, for Chase displays all the derring-do McDevitt is famous for giving his heroines. You will also be looking forward to the next, which McDevitt assures me is in the works.

Peter Watts's tale of the heedlessness of human greed began with *Starfish* (reviewed here in November 1999), which posited that an overcrowded, resource-short world could put power-plants on deep-sea rift zones, staff them with people whose psyches are twisted enough (or made twisted enough) to find the depths comfortable, and boobytrap them with nuclear bombs in case anything goes wrong. What went wrong was a mysterious infection, supposedly an ancient denizen of the deep sea, but when the bombs went off they triggered a tsunami that killed millions on shore. But, said the sequel, *Maelstrom* (April 2002), the bomb didn't kill all the rifters. A furious Lenie Clarke was walking across the seabottom and through shoals of rotting bodies to seek vengeance. Since she was infected with the Behemoth bug, when she got to shore, that's all she wrote, folks. Civilization crashed like a row of dominos.

Well, not quite. There were a few struggling to keep things going. And now we have **Behemoth: ß-Max**, which reveals that Clarke is now part of a rifter community sharing space on the seabed with the remnant refugees of corporate America. They've all been immunized against Behemoth. Or have they? People are getting sick, and the rifters are suspecting the corpses of tweaking the bug's genes in order to get even. Soon the rifters are blowing up Corpse habs, and it's up to Lenie Clarke, the woman who destroyed civilization to get even, to stop her fellow rifters from getting a little slice of the action for themselves.

Meanwhile, back on dry land, the South Africans are launching biowar with a bug called Seppuku. Desperate troubleshooters like Achilles Desjardins, whom we met in *Maelstrom*, are holding things in check, but not for long. Watts assures us that *Behemoth: ß-Max* is only half the third volume of his trilogy. The next will be *Behemoth: Sep-*

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puku, and it will wrap things up.

Will civilization crumble? Will Achilles Desjardins, with his own dark twists, hold things together? Will Lenie Clarke save her world, and perhaps the larger one as well? There's no telling at this point, but I think it safe to say that readers will be satisfied.

The biggest problem with Frank M. Robinson's **The Donor** is that an experienced SF reader, especially one with a modicum of awareness of recent reproductive-technology issues, will find it utterly predictable. The thriller market, on the other hand, should eat it up.

Here's the setup: Dennis Heller wakes up in a small San Francisco hospital after a car accident. He recognizes the surgeon as the same one who performed exploratory surgery on him in Boston and supposedly removed his gall bladder. Then he overhears the doc talking in the hall outside his room: ". . . wants us to go ahead—take the rest . . . he'll die . . . be an anesthesia accident . . ."

So he crawls out of bed and runs. Before long he's in another hospital and being told he's minus a kidney. And that gallbladder operation actually cost him a chunk of liver. A kind couple takes him in, and when a couple of thugs come looking for Dennis, they get killed. And we learn that his adoptive parents never wasted any love on him.

Get it?

Meanwhile, back in Boston, Robert Krost, son of billionaire Max, is wondering why Daddy isn't dying anymore. He was awfully sick, but he went out to San Francisco and came back a new man. And both Robert and Dennis look a lot like Max.

Get it now?

Robert and Dennis are both intelligent fellows. Their motivations are different, but they both want answers to questions. As they start researching, the details of the picture come together for the reader, who wonders why the heck they don't get it a lot sooner and run away to Australia (as if that might make their lives any safer—Max has a *lot* of money and no ethics at all). But they don't, which lets Robinson set up a rather nice shootout in the MASS MoCA art museum in North Adams, Massachusetts. Dennis's girl friend disappears, and there he is, staring at his grim fate. But Robert, lurking in the shadows, gets it at last, and the situation resolves decisively and happily.

Though there is a hint that the tale will go into reruns.

You'll enjoy Eric Brown's **Bengal Station**. The title refers to a floating arcology that dominates the Indian Ocean in a crowded future Earth. Its many decks teem with Indians and Thais, among others, and its docks welcome the void ships from the stars. Jeff Vaughan is a telepath (made by surgery and strengthened by implants) whose job it is to vet arriving ships for subversives and stowaways. Except . . . His boss keeps pulling him away from all ships from Verkerk's World. Suspicious, he asks Jimmy Chandra, a cop friend, to look into his boss's background. Keep him busy, he says, while I sneak past the guards he posts and check out the next ship.

The boss turns out to have a doctored dossier. The ship has a terrified girl and a mysterious mind-shielded container. The boss and his family commit suicide. The girl is the Chosen One, special to the Church of the Adoration of the Chosen One, and she promptly disappears. The container vanishes. And a friend of Vaughan's, a street kid, Tiger, dies of a new drug called rhapsody.

A bit of investigation reveals that the Church arose on Verkerk's World and uses rhapsody to achieve oneness with the divine—or what it claims is the divine. So Vaughan and Chandra are off to Verkerk's World to learn what is going on.

Meanwhile, Tiger's sister Sukara has been picked up by a mysterious stranger, Osborne, who takes her to

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Bengal Station. Sukara is desperate to find her sister, and because of the link between Tiger and Vaughan, she is destined to lead Osborne to the man he is hunting. But Vaughan returns from Verkerk's World hot on the trail of a massive conspiracy. If Osborne succeeds, millions will die. If he does not, Vaughan may just be able to come to terms with an extraordinarily painful past.

Ever heard of the Dinosaur Mafia? If not, here's your chance. Eric Garcia's **Hot and Sweaty Rex** is the third in a series of Dinosaur Mafia mysteries premised on the notion that the dinosaurs never went extinct. They just blended in, wearing latex suits so they could look human (and don't ask what they did before the invention of rubber! or why archeologists have never found any funny skeletons). Like us apes, many are perfectly fine folks, but some—hey, they're dinos!—have a fierce streak. Perhaps it's not surprising that some Families turned to bloody-handed crime.

So meet Vincent Rubio, a dino PI and recovering herbaholic (alcohol doesn't do much for dinos, but basil and cilantro are another matter). Hired to follow Nellie Hagstrom, a Hadrosaur from Florida in LA to talk with the local Raptor Family, he finds himself in a jam when Nellie skips town after a day. Hey, says the Boss Raptor. I paid you twenty grand for a day? You owe me two weeks—off to Florida, and do your job. Since an old lady friend has just showed up, and the Boss will spring for two tickets, Vinnie bows to the inevitable.

Poor Vinnie winds up in the middle of a gang war. The Hadrosaurs are headed by a childhood chum. The local Raptors are headed by the Boss's dim-witted brother. And they're after each other's throats, with the Raptors aided by an unsuspected spy in the Hadrosaur camp.

Unlikely though it be, it's fun. Light, frothy, peppered with jokes and wisecracks, it is also well imagined and paced. It is easy to see why Garcia is popular.

John Moore has surely read the Evil Overlord Manual credited to Peter Anspatch and available to anyone who knows how to use Google. Among other things, it abjures would-be Evil Overlords never to give a sucker an even break by, for instance, pausing to gloat before killing captured heroes, using doomsday devices with digital countdowns, or failing to kill cowardly thieves immediately. Lacking an equivalent manual for heroes, he made up the *Handbook of Practical Heroics* for his hero in **Heroics for Beginners** to find on a shelf. Then he set the scene—the kingdom of Deserae, whose Princess Rebecca is entertaining suitors such as Princes Kevin Timberline, diplomat, and Black Jack Logan, leader of men and defender of his home realm. Kevin's got an in with Becky, but when Thunk the Barbarian returns from the Fortress of Doom to utter no more than a cryptic deadline before dropping dead, it is clear that the local Evil Overlord, He-Who-Must-Be-Named, Lord Voltmeter, is now chortling evilly over his potent Ancient Artifact and Diabolical Device and plotting his move.

So the king decides Something Must Be Done, and he who gets it done will get Becky's hand. He also tells Kevin he can handle logistics while Logan gets the troops and the assignment to get that Something Done. That's when Kevin snaffles the *Handbook* and takes off on his own. Except for Becky, of course, who is Really Serious about helping out.

Now Kevin's a clever fellow, but the Evil Overlord has a Chief Minion and a Beautiful Assistant. Kevin does a nice job of exploring the ventilation ducts, but soon both he and Becky are chained in the dungeon, and the Evil Overlord, with the aid of his pt Mad Scientist, is about to fire up the Diabolical Device and destroy Black Jack Logan and his army.

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The happy ending, complete with the right guy getting the gal, is part of the package Moore is sending up, so the Astute Reader should have little trouble predicting the end. Getting there is a good deal of fun, for Moore has a gift for the comic, which means we can look forward to his next, *The Unhandsome Prince*.

It's meaningless light entertainment, and it's by one of our best. Elizabeth Hand has novelized the **Catwoman** script, and it's good pulp fun, just like the DC Comics original. Shy Patience Philips runs into a weirdness in the research lab of the cosmetics company where she works, flees, and is turned into the bold and powerful Catwoman. Now the evil and the rude must beware . . . So must the cop who is investigating a bit of the evil, though not quite for the same reason.

Have fun!

The Public Domain Enhancement Act (Eldred Act) was introduced in Congress in June 2003 as H.R. 2601. Its intent was to create a resource to let people find out what properties remain under copyright by requiring that copyright holders who care about maintaining control pay a small fee after fifty years and periodically thereafter. The reason behind it is that historically copyrights have expired after a "limited" time, as mandated under the Constitution, but that in the twentieth century that "limited" time has been extended so often and so greatly as to render it effectively unlimited. The driver is corporations such as Disney, which own intellectual property (e.g., Mickey Mouse) that is still valuable, even though under older copyright law it (or its earliest forms, the first Mickey Mouse was Steamboat Willie) would long since have passed into the public domain for anyone to use as they see fit. Attempts to block these extensions have been fruitless, for Disney and its ilk have the money and lobbyists. The intellectual property industry—not just cartoons, but also music and movies—have also pushed to extend the nature of copyright protection so that many activities which were once legal are now barred. Indeed, downloading music over peer-to-peer networks and cracking copy protections on CDs, DVDs, and games (as well as telling others how to do it) are now felonies carrying larger penalties than those imposed on people convicted of stock fraud, accounting swindles, and other genuinely harmful acts.

Fortunately, the other side has legal scholar Lawrence Lessig, who argues in his latest book, **Free Culture: How Big Media Uses Technology and the Law to Lock Down Culture and Control Creativity**, that American culture is as rich as it is because people have been free to modify preexisting intellectual property (Steamboat Willie ripped off a Buster Keaton film!). Today computer technology has made it possible for millions to do such things, but Disney is saying "As I did, thou shalt not do." Lessig has criticized this development at length in *Code and Other Laws of Cyberspace* (reviewed here in September 2001) and *The Future of Ideas* (September 2003). Now he returns to the fray, pointing out among other things that when technology changes, vested interests may try to quash it, as RCA did when FM came along. When they do not, as in the cases of photography and Japanese manga, the result can be an astonishing cultural efflorescence.

Piracy is a problem. Just the other day, I saw a news story concerning a fellow who used a camcorder to tape a brand new film so he could sell bootleg copies. But is the solution to outlaw all copying? Even copying of old songs that are no longer available as commercial product? That is the position of the Recording Industry Association of America (RIAA), which has sued even when it had no case and used the threat of legal costs to extort settlements.

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Open Source software movement, the Creative Commons (where creators put their work in the public domain, wholly or partially), and even statutory licensing (which permits musicians to use the songs of others, for a set fee).

Alas, balance does not seem to be in the cards. The Public Domain Enhancement Act remains in committee, and industry lobbyists are trying hard to kill it. It is as if, Lessig says, they fear the existence of the public domain. The industry wants "to assure that the public domain will never compete, that there will be no use of content that is not commercially controlled, and that there will be no commercial use of content that doesn't require *their* permission first. . . . Their aim is not simply to protect what is theirs. *Their aim is to assure that all there is is what is theirs.*" (italics in original)

The corporate dystopia is a traditional theme in SF. If you want to see it forming in the real world, read Lessig. If you want to stop it forming . . . Lessig suggests that it would be good if we could make copyright terms shorter again, but I suspect that even if we all wrote our congresscritters to urge that, not much would happen. He also—even though he himself is a lawyer—suggests that we should reduce the number of lawyers.

Ain't gonna happen, is it? ■

Some of mankind's most terrible misdeeds have been committed under the spell of certain magic words or phrases.

—James Bryant Conant

Today the world is the victim of propaganda because people are not intellectually competent. More than anything the United States needs effective citizens competent to do their own thinking.

—William Mather Lewis

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BRASS TACKS

Dear Stan,

Responding to your November 2003 editorial, Greg Ostrom huffs in his letter published in the June *Analog* that he doesn't buy from Toshiba because they sold CNC equipment to the Soviet Union, doesn't subscribe to *Scientific American* because of its "deliberate mixing of politics with science" (because, I'm guessing, it has published articles supporting the ideas of "nuclear winter" and human-caused global warming), boycotts French products because the French government has not supported George and Tony's excellent adventure (or bogus journey, if you prefer) in Iraq, and plans to avoid movies which support actors "who have endangered our troops by encouraging our enemies."

This is, of course, his right as an American. Having previously supported such measures as boycotting apartheid South Africa, I can hardly object if he chooses to express his own political opinions through his purchasing decisions. I do wonder, however, if he also boycotts IBM, which in its pre-computer days provided Nazi Germany with tabulating machines the Reich used to keep the Holocaust running smoothly, or Ford, whose European subsidiaries built military vehicles for the Reich and whose founder was credited by Baldur von Schirach (head of the Hitler Youth) for converting him to anti-Semitism through his publication of the Protocols of the Elders of Zion. And does he plan to boycott Mel Gibson movies now that the actor-producer has made a film which revives the ancient charge that the Jews killed Christ? That, after all, encourages anti-Semites in the Arab world (and elsewhere), many of whom have terrorist associations or are terrorists themselves.

And what, exactly, counts as "encouraging our enemies"? If any criticism of the war in Iraq, or of the handling of the struggle against terrorism by the Bush administration, or of the administration or its officials in general, can be condemned as, essentially, treason ("giving aid and comfort to the enemy" is how the Constitution puts it), how long can it be before critics are made to disappear? What, exactly, are we fighting to preserve, if we're willing to junk democracy?

In another letter in the same issue of your magazine, Glenn Damato sniffs contemptuously at those who complain about the loss of free speech in America despite the fact that the U.S. went to war "even after multitudes of protesters marched on every major city."

All that shows is that the Bush administration doesn't listen to "free speech" which says what it doesn't want to hear. And more and more, George W. Bush is protected from even having to hear such speech: when Mr. Bush makes a

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public appearance, it's increasingly common for protesters to be herded (sometimes by armed police) into "free speech zones" half a mile or more away from where he is to speak, while pro-Bush people are invited right up close. This is a deliberate abrogation of free speech rights, ostensibly in the name of "security." It's also stupid: if someone hostile to Bush wanted to harm him, what would stop that individual from posing as a Bush supporter, getting up close with the rest, and shooting him? I can't believe that hasn't occurred to the Secret Service, so such measures seem intended less to protect the President than to stifle dissent.

"Exporting democracy" isn't supposed to mean getting rid of what our government considers a surplus.

Eric B. Lipps
Staten Island, NY

Dear Mr. Schmidt:

I presume that it wasn't pure coincidence that the story by LLoyd Biggle, Jr. (his very last story?) appeared in the November issue along with your editorial.

I've always had my eye out for Biggle's stories since I read "The Still, Small Voice of Trumpets" when it came out in April 1961. (I still remember the illustrations by Kelly Freas, also.) His motto, DEMOCRACY IMPOSED FROM WITHOUT IS THE SEVEREST FORM OF TYRANNY, seemed to me to be true. Mr. Williamson, as well as Mr. Bush, has either not read the story (stories) or not understood this.

Having lived in Germany for almost 30 years now, I've changed my ideas somewhat on Biggle's motto. It seems to me that a more correct version is: IT IS IMPOSSIBLE TO IMPOSE DEMOCRACY ON A PEOPLE FROM WITHOUT. After WWII, the U.S. wanted to make a democracy out of totalitarian Germany. The attempt has failed. How many of the former European colonies in Africa and Asia have developed into a functioning democracy? The new, proposed constitution for the European Union is completely undemocratic and no one seems to be disturbed. There are no limits on the powers of the government in Brussels and none of the officials there are elected and so directly responsible to the citizens.

Might I add in closing, that freedom in the U.S. has been increasingly curtailed during the last 70 years because of increased governmental regulation. This process took a quantum jump after Sept. 11, 2001. But, as in Europe, no one seems to be disturbed. Why not?

Fred O. Bushnell, Jr.
Germany

Dear Mr. Schmidt,

As a long time reader of *Astounding/Analog* (first issue 71 years ago), I have not been an active fan or correspondent. However, the story "BLU 97-0230" by Alexis Glynn Latner contained something I have found to be very rare in science fiction. On page 66 [of the June issue], bottom paragraph, in the right-hand column, is a vivid, accurate, moving description of personal tragedy and loss that affected me deeply and personally. I lost my wife of 53 years a short while ago, and I can assure the author that the brief description given is remarkable! I would appreciate it if you would convey my regards to the author for both that paragraph and the whole story.

Oh, yes. I have read every issue of *Astounding* from the beginning (I bought all the unread back issues) and have followed the development of the art from roaring space opera to the present. I even met John Campbell at the old Street and Smith offices when I was still in College in the 1940s.

Again, thank you; the magazine remains my main source of modern S-F.

Thomas J. Petrick, MD

Dear Stan,

Regarding Kelvin Throop's "Do Unto Others": AMEN!

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Improbable, as advertised, but also unnecessary. The Creator has already programmed this world to handle overpopulation, with mechanisms like famines and increasingly deadly viruses. If we work our way through those and still don't get the message, we will eventually reach the point where we need to minimize the recycle time for the nutrients tied up in our bodies. There, the prion (as in Mad Cow Disease) is waiting to finish the job. (Soylient Green, anybody?)

R.A. Brouse
Orland, CA

But there's a crucial difference between those "solutions" and the one in Throop's story. It is left as an exercise for the reader....

Dear Sir:

For a longer time then I care to think about, I have been a subscriber to *Analog*. I always read the editorials and have disagreed several times. I have even written angry letters, in my head. This is not one of those, but it made me want to make a couple points.

First of all, I am not sure of any way you could ever prove the negative that there is no other intelligence in the universe. Proving any negative can be hard enough. Proving, absolutely, something that is this important to so many people would be very difficult and I cannot envision any "proof" that would satisfy everyone. Many would say, up to the last inch of the universe was explored, that we simply had not looked on the right places yet. I know that I am being picky but, to me, if the basic premise is flawed, so is the argument that follows. Enough of that, though.

Your second argument is the one I have more trouble with. Let's assume that we can establish, to everyone's satisfaction, that we are alone in the universe. If I read your editorial right, you feel it would have little effect on our urge to explore the universe. This is where we part company. People explore for three reasons. The first is for some kind of gain (gold, new land, resources, etc.); the second is to see what is over the next hill. To "boldly go," etc. Yes, both of these reasons will remain. The urge to explore will not go away.

However, I feel there is a third reason that would go away if we were sure no one new would be found out there. From the time we decided to go into the next valley, part of the motivation has always been, "Who is out there and what are they like?" Part of our literature of unknown lands has always been the people and the societies we might find there. From Atlantis to the lost cities assumed to be in the New World and Africa to Shangri La and to races of aliens. We have envisioned whole cultures with beings who were strange and wonderful. Much of these were no more then reflections of our times and what we wanted things to be like. Still, I believe that if we were sure that there were none of these people out there, part of the soul would be gone from our exploration, and I am not so sure there would even be as much overall interest in finding out about the universe as you seem to think.

Dan Hillen
St. Ann, MO

Dear Mr. Schmidt,

I found your editorial in the June issue to be thought-provoking. Here's what I've come up with:

Regarding the lack of alien contact: I think it's arrogant to assume that an alien civilization would necessarily use something as "sloppy" as radio waves to communicate. Also, what stops them from using a frequency that's absorbed by the cosmic background?

Regarding the shock of alien contact: Assuming that the aliens are peaceful, there is a certain group of people who would welcome them readily: Trekkies! Devotees of the show, who believe in IDIC (Infinite Diversity in Infinite Com-

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bination), would be much less prone to culture shock because they're already used to the idea of aliens. Of course, if the aliens are hostile, all bets are off!

Regarding the possibility of alien demeanor: The only possible support for the notion that aliens might be peaceful comes from our own history. Mankind has never achieved any truly significant social efort without it being the result of group cooperation. Logically, aliens would never achieve space flight on an intergalactic scale without being peaceful enough to work together. Of course, they *are* aliens....

Regarding alien technology shock: I predict that within the first year after humans understand any alien super technology that we improve upon it, and continue to do so exponentially. Witness Moore's Law.

The rest of the issue was thoroughly enjoyable. As always, you've educated and entertained me, and I thank you!

David McGinley
Waymart, PA

Dear Dr. Schmidt:

After reading Jeffrey Kooistra's rebuttal of Ben Bova's rebuttal, I went back and re-read his original rebuttal and I must say it impressed me much more than it did the first time. I still have one major problem with it however, namely where he finds it unfair that SETI people are taken seriously and UFO folks aren't. There's a very good reason for taking SETI more seriously than UFOs. SETI can succeed, eventually, if there are other intelligent life forms anywhere in the observable universe. UFO research can only succeed if they're here on Earth—the one place in all the cosmos where extraterrestrials are, by definition, just a bit out of place. Granted, SETI also makes the assumption they're broadcasting signals we can pick up, but this is a relatively small handicap when you compare the size of the volumes the two groups are searching. After all, if aliens are here, they almost certainly exist elsewhere as well, but the converse does not follow.

Not to say serious UFO research isn't a good idea, if only because of the enormously greater consequences if the UFO people are right. ETs zipping through our own atmosphere have got to be of more immediate concern than ETs orbiting Delta Pavonis. But my money is on the SETI people succeeding first. And by enormous odds.

I guess I'm with Mr. Bova on this one though—I wouldn't put that much money on either one. Unless intelligent species are very rare indeed, we really should have come across unambiguous evidence of their existence by now, and whatever you say about UFO evidence, it's not unambiguous.

So assuming Ben and Isaac are right, why is intelligence so rare? What could be so unusual about our biosphere that makes it give rise to something that's found almost nowhere else?

My guess is its age.

Just how often does a biosphere get to be four billion years old? Life, after all, is a fairly fragile thing and four billion years is a long, long time. What if it really does take that long for intelligence to evolve? How often does it get the chance?

Maybe the factor we need to start thinking more about is average biosphere lifespan. If it's as long as a hundred million years (which has got to be a good long stretch) then it's likely that only one in a trillion biospheres ever give rise to intelligent life and we very well might be alone in the Milky Way.

Presumably someone has already tried to estimate the average lifespan, but, if they have, I haven't heard of it. They'd have to take into account all major threats a biosphere might face like other stars' Oort clouds and nearby supernovas and they'd still probably drastically underestimate it as we almost certainly don't know about everything that can kill us. The one thing they shouldn't do is start with the Earth's lifespan and

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reason back from that.

Earth, quite likely, has been very lucky.

Andre Duval
Seattle, WA

Dear Stan,

Regarding the June issue, I was amused to read the editorial, Bova's letter, and Kooistra's rebuttal, at the same time noting that you intend to sample Brass Tacks through the years for your 75th anniversary issue. I've been reading *Astounding/Analog* since about 1949, when I was 12, almost continuously until the present, and I vividly remember the running arguments in Brass Tacks that went on for months, back in the '50s, although due to the delay from letter writing to publishing, they were often hard to follow. It might be fun if you could run some of those arguments sequentially in your reprise.

By the way, did Jean Shepard of WOR radio and PBS ever write anything that appeared in the magazine? If so, I'd love to see it. (I'm sure it would have been before 1980, and I don't know how to look that up on your website.) Google doesn't help.

In another vein, since you're looking back, maybe it's time for another "Best of *Astounding/Analog*" collection?

Doug McGarrett
Rocky Point, NY

By now you've already seen Kyle Kirkland's history of Brass Tacks, which would have fit very nicely into the 75th-anniversary issue but wouldn't wait. However, as you'll see next month (and in "In Times to Come" this month) we do have some special stuff on tap for the anniversary. ■

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UPCOMING EVENTS Anthony Lewis

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26–29 November 2004
LOSCON 31: ESCAPE TO LA (Southern California SF conference) at LAX Marriott, Los Angeles, CA. Guest of Honor: Tim Powers. Fan Guests of Honor: James Stanley Daugherty, Kathryn Daugherty. Registration: $40 until 3 October 2004, $45 at the door. Info: Loscon 31, c/o Los Angeles Science Fantasy Society, 11513 Burbank Blvd., North Hollywood CA 91601; info@lasfs.org; www.loscon.org/loscon31/

3–5 December 2004
SMOFCON 22 (SF convention-runners conference) at Wyndham Washington Hotel, Washington DC. Registration: $50. Info: SMOFcon 22, c/o Bob MacIntosh, 7113 Wayne Dr., Annandale VA 22003-1734; www.wsfa.org/smofcon.htm.

10–12 December 2004
PHILCON 2004 (Philadelphia area SF conference) at Marriott Hotel Center City, Philadelphia, PA. Principal Speaker: Brian W. Aldiss. Artist Guest of Honor: Joe DeVito. Special Guests: Kevin J. Anderson & Rebecca Moesta, Jolly R. Blackburn & Brian Jelke, Tom Purdom. Registration: $40 in advance, more at the door. Info: Philcon, Box 3, Oreland PA 19075; info@philcon.org; www.philcon.org.

25 December 2004
(High Arctic SF conference) at The Ninety North Motel. Guest of Honor: Christopher Kringle; Artist Guest of Honor: John Frost. Registration: free, but limited to good little boys and girls. Info: www.santaclaus.int.

4–8 August 2005
INTERACTION (63rd World Science Fiction Convention) at Scottish Exhibition and Conference Centre, Moat House & City Inn Hotels, Glasgow, Scotland. Guests of Honor: Robert Sheckley, Jane Yolen, Greg Pickersgill, Lars-Olov Strandberg. Registration until 30 November 2004: Attending USD170/GBP 95/EUR 145, Supporting USD45/GBP 30/EUR 45; Child's USD50/GBP32/EUR50. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Info: Interaction, 379 Myrtle Road, Sheffield, South Yorkshire S2 3HQ, U.K. or Interaction, P.O. Box 58009, Louisville, KY 40268-0009; info@interaction.worldcon.org.uk; www.interaction.worldcon.org.uk.

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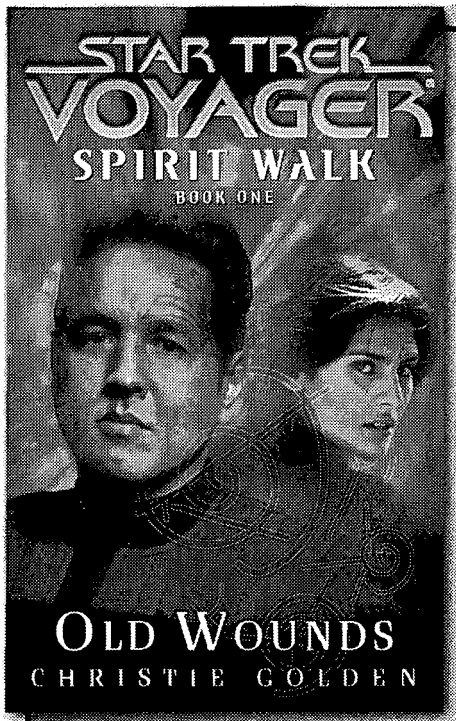

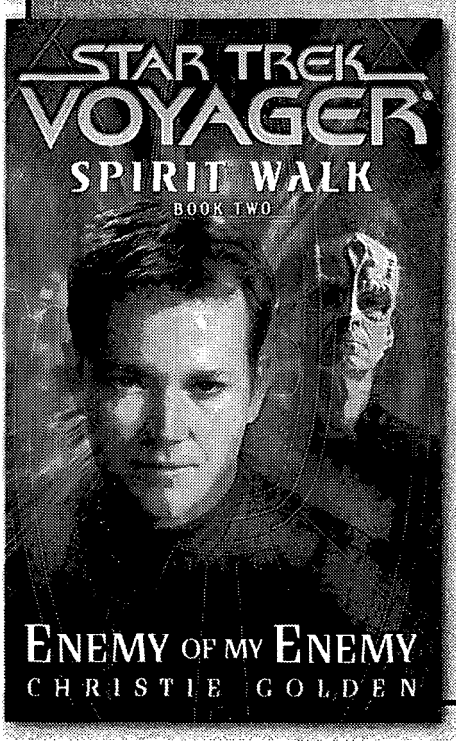

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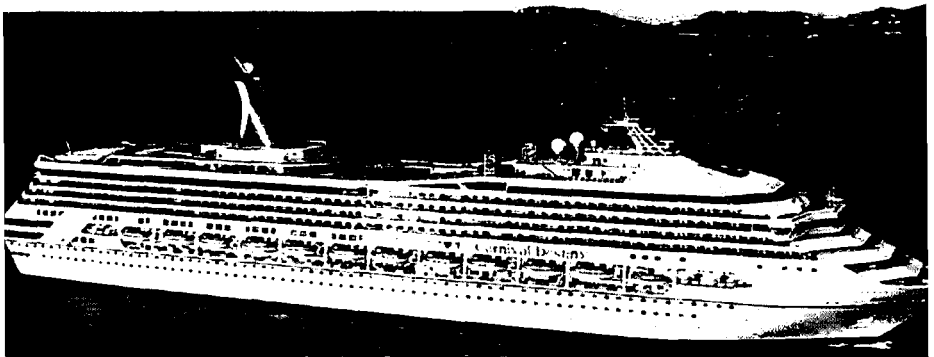

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